PAGE'S WEEKLY.—August 25, 1905. **Thin Paper Copy for Circulation Abroad.**

No. 50. Vol. 7.

SIXPENCE.
(Registered as a Newspaper.)

**FRIDAY,
AUGUST 25, 1905.**

267

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PAGE'S WEEKLY

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PAGE'S WEEKLY Miscellaneous

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Consulting and Organising Engineer for Water Works and Industrial Undertakings,

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Telephone No.: 5754 Bank. Write for particulars.

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On Admiralty List.
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Why build High Towers and Elevated Water Tanks?

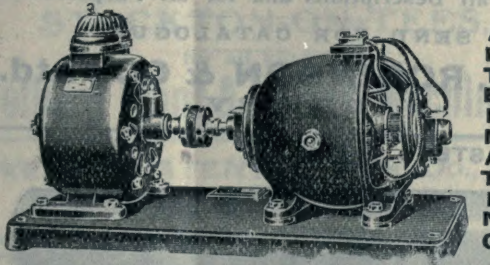
I can store water UNDER PRESSURE in ANY POSITION, and deliver it to ANY ELEVATION at any DESIRED PRESSURE.

Catalogues on application.

ERIC S. A. SMITH,

BRIDLINGTON.

The Crypto Electrical Co.,



ALTERNATING TRANSFORMERS

3, TYERS GATEWAY, BERMONDSEY STREET, LONDON, S.E.

Bogie Locomotives for Short Curves. A large number of these Engines have been built to NARROW and to NORMAL GAUGE.—For full particulars, and for Licences, &c., address the HAGAN'S LOCOMOTIVE WORKS, ERFURT, GERMANY.

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615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.
Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.

PAGE & ROWLINGSON,

Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

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And 14, St. Ann's Square, Manchester.

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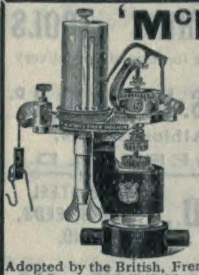

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Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

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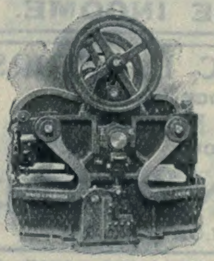
PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000h.p. generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing Sept. 1st, page 37.

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.



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PAGE'S WEEKLY Miscellaneous

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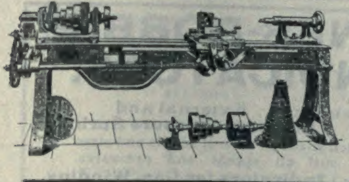

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Tested to 350 lb. Steam Pressure.
For High Pressure Boilers.

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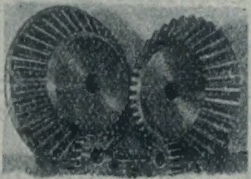

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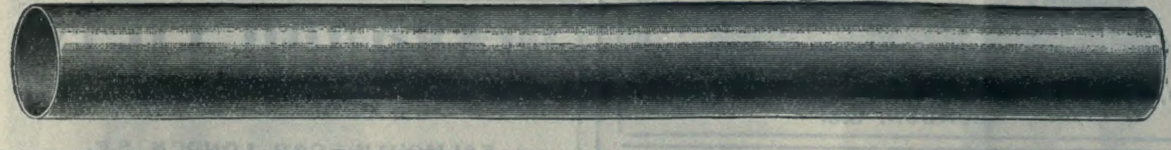

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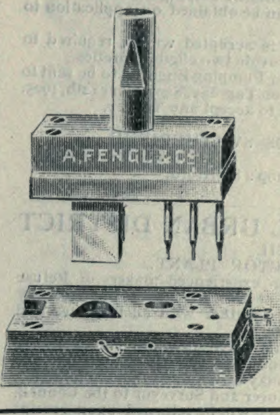

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MACHINE TOOLS.
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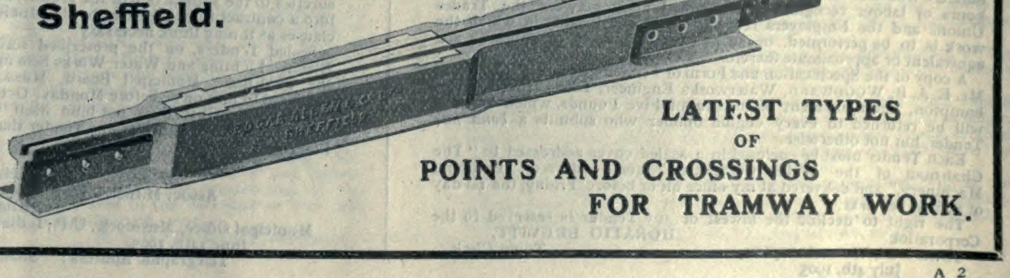
Limited,
Sheffield.



LATEST TYPES
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POINTS AND CROSSINGS
FOR TRAMWAY WORK.

PAGE'S WEEKLY Contracts

CONTRACTS.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

WATERWORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite **TENDERS** for the **SUPPLY** and **ERECTION** at their Waterworks of a **CORNISH BOILER**, 16 ft. long by 6 ft. diameter, fitted with Meldrum's Patent Furnaces.

Specification and Forms of Tender can be obtained on application to the undersigned on payment of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Waterworks, Cornish Boiler," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, the 19th day of September, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.
Council Offices, 7, North Street, Bishop's Stortford.
August 14th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

AMENDED ADVERTISEMENT.

SEWAGE WORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite **TENDERS** for :—

Supplying and Fixing Gas Pumping Engine, Suction Gas Plant and Sewage Pumps at their Sewage Pumping Station.

Specification and Form of Tender can be obtained on application to the undersigned.

The person or firm whose Tender is accepted will be required to enter into a written contract, and to provide two eligible sureties.

Sealed Tenders, endorsed "Tender for Pumping Engine," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, September 12th, 1905.

The Council do not bind themselves to accept any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.
Council Offices, 7, North Street, Bishop's Stortford,
July 21st, 1905.

MERTHYR TYDFIL URBAN DISTRICT COUNCIL.

REFUSE DESTRUCTOR PLANT.

The Council invite **TENDERS** from experienced makers of Refuse Destructor Plant for the **ERECTION** of **PLANT** capable of effectually burning 120 tons of refuse per day, together with all buildings and contingent works connected therewith.

The Council have selected three alternative sites, and copies of the site plans, together with "General Conditions and Particulars for the guidance of Contractors tendering," may be obtained upon application to T. FLETCHER HARVEY, Esq., Engineer and Surveyor to the Council, upon payment of a fee of £3 3s., which will be returned upon receipt of a *bona fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Destructor Plant," must be delivered to T. Aneuryn Rees, Esq., Clerk to the Council, on or before September 1st, 1905.

T. FLETCHER HARVEY,
Engineer and Surveyor to the Council.
Town Hall, Merthyr Tydfil,
June 16th, 1905

COUNTY BOROUGH OF WOLVERHAMPTON.

TETTENHALL PUMPING STATION EXTENSIONS.

CONTRACT No. 2.

The Corporation of Wolverhampton are prepared to receive **TENDERS** for a **VERTICAL TRIPLE-EXPANSION PUMPING ENGINE** and **OTHER WORK** connected therewith from engine builders who will undertake to pay the rate of wages and observe the hours of labour recognised and agreed upon between the Trades Unions and the Employers respectively in the locality in which the work is to be performed, or such a rate of wages or hours as are equivalent or approximate thereto.

A copy of the Specification and Form of Tender may be obtained from Mr. E. A. B. WOODWARD, Waterworks Engineer, Town Hall, Wolverhampton, upon payment of the sum of Five Pounds, which amount will be returned to every engine builder who submits a *bona fide* Tender, but not otherwise.

Each Tender must be enclosed in a sealed cover addressed to "The Chairman of the Water Committee," and endorsed "Pumping Machinery," and delivered at my office on or before Friday, the 1st day of September next.

The right to decline the lowest or any Tender is reserved to the Corporation.
HORATIO BREVITT,
Town Clerk.
Town Hall, Wolverhampton,
July 4th, 1905

SELBY URBAN DISTRICT COUNCIL.

NEW WATERWORKS.

PUMPING MACHINERY.—CONTRACT No. 6.

TENDERS are hereby invited for the **CONSTRUCTION, DELIVERY**, and **ERECTION** of **DUPLICATE PUMPING MACHINERY** in connection with the above works, comprising Boilers, Triple-expansion Engines, Surface Condensers, Force Pumps, Head Gear, and Borehole Pumps, with a capacity equal to raising 32,000 gallons per hour under a head of 310 ft.

Copies of the Plans and Specifications will be supplied on application to the Engineers, Mr. PERCY GRIFFITH, M.Inst.C.E., 54, Parliament Street, Westminster, S.W., and Mr. BRUCE MCGREGOR GREY, Assoc. M.Inst.C.E., Council Offices, Selby, Yorkshire, on payment of £5, which will be returned to all contractors who shall submit a *bona fide* Tender for the work on or before the 28th day of August, 1905.

Tenders must be made on the form provided, and delivered under seal to the undersigned by the date above named.

Every Tender must state the periods required respectively for the delivery and the erection of the machinery, also the guaranteed duty of the engines.

The Council do not bind themselves to accept the lowest or any Tender.

By order of the Council,
(Signed) J. H. BANTOFT,
Clerk to the Urban District Council.
Council Offices, Selby, dated the 25th of July, 1905.

MUNICIPAL BOARD OF MUSSOORIE, INDIA.

WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY AND DELIVERY of the following :—

(*a*) Pipes ; (*b*) Tees ; (*c*) Cross Pieces ; (*d*) Reducers ; (*e*) Bends ; (*f*) Bends and Collars ; (*g*) Sluice Valves and Stop Cocks ; (*h*) Ball and Non-return Valves.

Specifications and Form of Tender can be obtained on application to the undersigned, on payment of a deposit of Rs. 45 (£3), which amount will be returned on receipt of a *bonâ fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 3 (4s.) each, which will not be returned.

The firm whose Tender is accepted will be required to deposit the sum of Rs. 1500 (£100) in a bank, and the receipt, endorsed in favour of the Chairman, must be forwarded with the Tender. This amount will be forfeited on the failure of the Tenderer to execute a formal contract bond within two months of the acceptance of his Tender.

Sealed Tenders, on the prescribed form, endorsed "Tender for Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 9th, 1905.

The Municipality does not bind itself to accept the lowest or any Tender.

By order, C. H. SHANAN,
Assoc.M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.
Municipal Office, Mussoorie. U.P., India,
June 14th, 1905.
Telegraphic Address : "Shanan. Mussoorie."

MUNICIPAL BOARD OF MUSSOORIE, INDIA.

ELECTRIC LIGHTING AND WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY, DELIVERY, and ERECTION at sites, in complete working order, of the following plant :—

(*a*) Steel Power Pipes ; (*b*) Water Motors ; (*c*) Alternators with Exciters ; (*d*) Switchboards with Instruments and Apparatus ; (*e*) Transformers ; (*f*) Induction Motors ; (*g*) Pumps ; (*h*) Workshop Machines.

Also for the **SUPPLY** and **DELIVERY** of the following :—

(*a*) Bare Copper Wire for Overhead Mains ; (*b*) Insulators and Lightning Arresters ; (*c*) Arc and Incandescent Lamps ; (*d*) Telephone Equipment ; (*e*) Workshop Tools ; (*f*) General Stores.

Specifications, Form of Tender, and General Conditions can be obtained on application to the undersigned on payment of a deposit of Rs. 75 (£5), which amount will be returned on receipt of a *bona fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 5 (6s. 8d.) per set, which will not be returned.

The Firm whose Tender is accepted will be required to find two sureties to the satisfaction of the Municipality, and to enter with them into a contract to be prepared by the Municipality, and to contain such clauses as it may think necessary.

Sealed Tenders, on the prescribed form, endorsed "Tender for Electric Lighting and Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 23rd, 1905.

The Municipality does not bind itself to accept the lowest or any Tender, nor will it consider any Tender that is not for the whole of the Plant and Material.

By order,
C. H. SHANAN,
Assoc. M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.
Municipal Office, Mussoorie, U.P., India,
June 14th, 1905.
Telegraphic Address : "Shanan, Mussoorie."

PAGE'S WEEKLY Contracts and Appointments Open

BOROUGH OF ASHTON-UNDER-LYNE.

ELECTRICITY DEPARTMENT.

The Electricity Committee invite **TENDERS** for the following works, viz.:—

SECTION A.—For One 500 K.W.D.C. GENERATOR.
" B.—For One WATER-TUBE BOILER, with Superheater, to be worked in conjunction with a refuse destructor.
" C.—For Two SUPERHEATERS for Lancashire Boilers:

Copies of the Specification and Form of Tender can be obtained from the Borough Electrical Engineer, Wellington Road, Ashton-under-Lyne, on payment of a deposit of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Electricity Works," addressed to the undersigned, must be received not later than 12 noon Saturday, September 2nd, 1905.

It will be a condition of the contract for Section B that boilers similar to the one offered can be seen in successful operation in conjunction with a refuse destructor.

BOROUGH OF TAUNTON.

The Corporation of Taunton are prepared to receive **TENDERS** for the following:—

One **WATER-TUBE (STRAIGHT) MARINE-TYPE BOILER**, fitted with Superheater and Economiser; also **HIGH-PRESSURE PIPE EXTENSIONS** and **SUNDRY IRONWORK**.

Specification, with Tender Form, etc., can be obtained from the Borough Electrical Engineer, St. James Street, Taunton, on payment of 5s.

Tenders to be delivered and endorsed "Boiler, etc.," to GEORGE H. KITE, Esq., Town Clerk, Municipal Buildings, Taunton, not later than Saturday noon, September 2nd, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

ED. B. THORNHILL,
Borough Electrical Engineer.
St. James Street, Taunton, August 15th, 1005.

COUNTY BOROUGH OF SOUTHAMPTON.

TO ENGINEERS AND OTHERS.

The **CORPORATION** invite **TENDERS** for **SUPPLYING** and **FIXING** at the Corporation Wharf, Chapel, three 18-in. **HIGH-PRESSURE DIRECT-ACTING CENTRIFUGAL PUMPING ENGINES**, including all Suction and Delivery Pipes, Steam and other connections.

Particulars may be obtained upon application to Mr. J. A. CROWTHER, A.M.Inst.C.E., Borough Engineer, Market Chambers, 123, High Street, Southampton.

Sealed Tenders, endorsed "Tender for Pumping Engines," must be delivered at my office before 2 p.m. on Monday, the 4th September next.

No pledge is given to accept the lowest or any Tender.

By order,
R. R. LINTHORNE,
Town Clerk.
Town Clerk's Office, Municipal Offices, Southampton,
July 21st, 1905.

BOROUGH OF MORLEY.

TO CAST IRON PIPE MANUFACTURERS.

CONTRACT No. 1.

The Waterworks Committee of the Corporation invite **TENDERS** for the **MANUFACTURE** and **DELIVERY** of 14,668 yards of **CAST IRON PIPES**, 15 in. internal diameter.

The Pipes are to be delivered at various places between the Borough of Morley and the Borough of Brighouse.

Drawings may be seen and Copies of the Specification, Bill of Quantities and Form of Tender may be obtained on application to the undersigned.

Tenders sealed and endorsed "Cast Iron Pipes," to be delivered at the Town Clerk's Office not later than 10 a.m. on Friday, the 1st day of September, 1905.

The lowest or any Tender not necessarily accepted.

W. E. PUTNAM, Assoc.M.Inst.C.E.,
Borough Engineer and Surveyor.
Town Hall, Morley, August 14th, 1905.

NORTH-EASTERN RAILWAY.—TO CONTRACTORS.

—The **DIRECTORS** are prepared to receive **TENDERS** for the **CONSTRUCTION** and **ERECTION** of the **NEW STEEL SWINGBRIDGE** over the River Hull at Sculcoates, on their Victoria Dock Branch, and weighing about 460 tons. The Contract will include the Removal of the existing Swingbridge, the Raising of the Public Road, and the Building of River Walls, Timber Jetty, &c. Plans may be seen, and Specification, detailed Lists of Quantities, and Forms of Tender obtained, on personal application at the office of Mr. W. J. CUDWORTH, the Company's Engineer, at York, on and after August 14th, 1905. The Directors do not bind themselves to accept the lowest or any Tender. Sealed Tenders, marked "Tenders for the Reconstruction of the Swingbridge at Sculcoates," to be sent to the Secretary at York not later than noon on Monday, September 11th, 1005.

York, August 3rd, 1905. R. L. WEDGWOOD, Secretary.

APPOINTMENTS OPEN.

APPOINTMENT OF COUNTY SURVEYOR.

DERBYSHIRE COUNTY COUNCIL.

The Council invites **APPLICATION** for the **POST** of **COUNTY SURVEYOR** at a salary of £500 per annum, rising by annual increments of £25 to £600. No pension.

The Surveyor shall devote the whole of his time to the duties of the office, and shall have the entire charge of all roads and bridges under the care and control of the County Council. He shall supervise and report on the work of the district surveyors and of the Local Authorities who have claimed to repair their main roads whether under contract or not. He shall attend all necessary meetings, and shall prepare such plans, estimates, and reports as may be required.

The Surveyor must have a thorough practical knowledge of the making and maintaining of roads, of the different materials employed, of the best methods of using steam rollers, and of the management of roadmen, and no testimonials will be considered unless the applicant can show he possesses these qualifications.

The Council will provide offices, clerical assistance, and stationery, and an ample allowance for travelling will be made, but this will be arranged with the Surveyor after his appointment.

The Surveyor must also carry out any further duties that the Council may require from time to time.

The appointment will be made subject to determination on three months' notice by either side.

Canvassing directly or indirectly will disqualify.

Particulars of duties, &c., can be obtained from, and all applications, accompanied by copies of three recent testimonials (originals will not be returned), must be sent on or before the 6th day of September, 1905, to the undersigned. N. J. HUGHES-HALLETT,
County Offices, Derby. Clerk of the County Council.

CRAWFORD MUNICIPAL TECHNICAL INSTITUTE, CORK.

WANTED, a **TEACHER** of **MECHANICAL ENGINEERING** at a salary of £200 per annum. Whitworth Scholar preferred. He will be expected to teach mechanical engineering, theory and practical work in laboratory, workshop practice in a fully equipped workshop and smithy, machine construction and drawing office work, mathematics and steam.

Further particulars of duties can be obtained from E. A. O'KEEFE, B.E., M.I.E.E., with whom applications must be lodged on or before Thursday, August 31st.

Canvassing will disqualify.

By order of the Committee,
F. B. GILTINAN, Secretary.
Emmet Place, Cork, August 1st, 1905.

THE MADRAS RAILWAY COMPANY

REQUIRE the services of a **BRIDGE INSPECTOR** in India

Candidates, preferably unmarried, must have been trained as platers, riveters, and girder erectors in one of the leading shops in the United Kingdom, and be experienced in the erection of false works and girders, and be capable of taking sole charge of such work.

Commencing salary Rupees 250 per month, rising to Rupees 300; after two years of approved service, covenant for four years. Free passage to Madras.

Application, stating age, experience, &c., to be addressed not later than September 18th to W. H. COLE, Secretary.
1, Broad Street Place, Finsbury Circus,
London, August 16th, 1905.

URBAN DISTRICT OF HANDSWORTH,

IN THE COUNTY OF STAFFORD.

ELECTRIC SUPPLY DEPARTMENT.

APPOINTMENT OF STATION SUPERINTENDENT.

The Urban District Council invite **APPLICATIONS** for the above-named office.

Salary £120 per annum, with house (rent, rates, and taxes free), light, and water.

Every candidate must have had a thorough training as a Mechanical Engineer. Preference will be given to one who has had marine experience and who possesses a Board of Trade certificate. It is desirable (though not essential) that candidates should have had experience in an electric supply station.

The person appointed will be held responsible to the Engineer for the efficient and economical running of the supply station, and for the management of the men. He must be able to execute any repairs to the plant or to perform any of the duties of the watch engineers or other station hands when required to do so.

He must devote the whole of his time to the performance of the duties of his office, and will not be permitted to take any other business employment.

Applications in handwriting of candidates, giving age (which should not be less than 28 or more than 40 years), whether married or single, and particulars of training and experience, with three recent original testimonials, must be sent to me, marked "Station Superintendent," by post before noon on Wednesday the 30th instant.

The Committee will, after considering the applications, request the attendance of such candidates as may be selected, and pay their second-class return railway fares. H. WARD, Clerk to the Council.
Council House, Handsworth (Staffs), August 15th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 23 *and* 25.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. *for each additional section.*

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phoenix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY **Aerial Ropeways**

AËRIAL ROPEWAYS

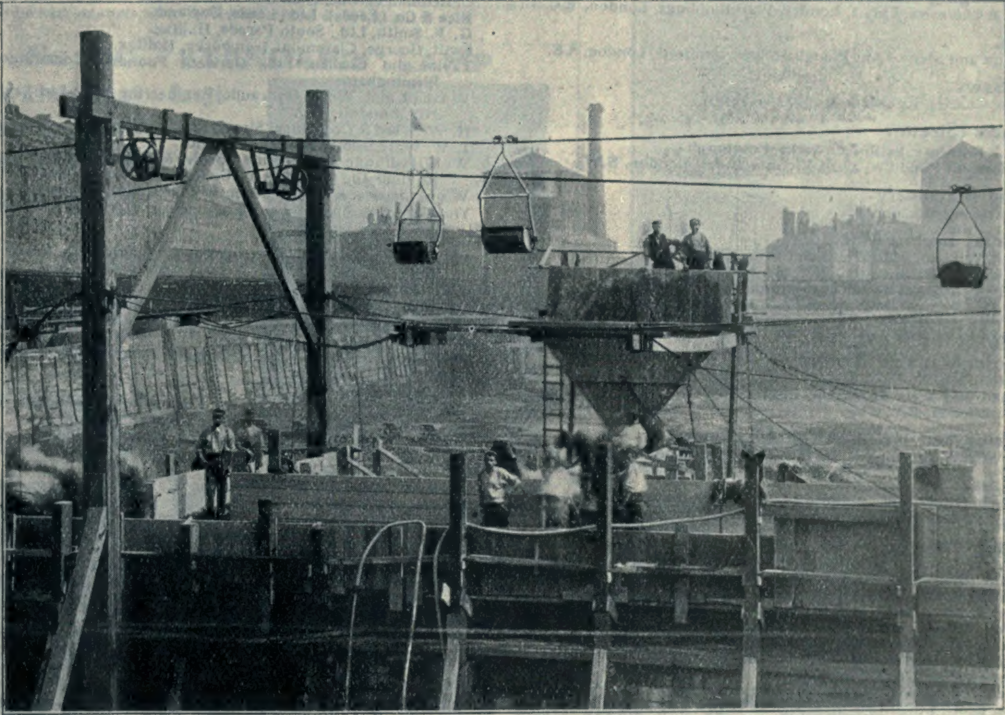
AND INCLINES ON ALL SYSTEMS

DESIGNED AND CONSTRUCTED BY

BULLIVANT & CO., LTD.

FOR THE CARRIAGE OF PASSENGERS, MINERALS, ETC.

EXAMPLES AT WORK ALL OVER THE WORLD.



Ropeway constructed for the Corporation of Liverpool to convey concrete required in building a road bridge over the dock.

Ropeways constructed to convey from 50 to 2,000 tons per day.
Suitable for the transport of all descriptions of materials.

Makers of

FLEXIBLE STEEL WIRE ROPES FOR CRANES, LIFTS, HOISTS, ETC.

Contractors for MINING AND HAULING PLANT.

Regd. Office: 72, Mark Lane, E.C. **LONDON.** Works: Millwall, E.

Telephone: 2110 Avenue.

Write for Pamphlets R and R R.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

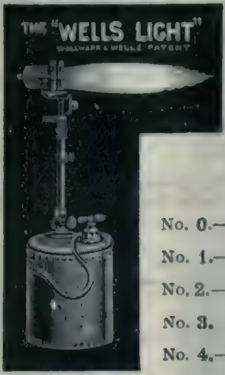
Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Wells' Specialities



PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED.

Horizontal Flame Unaffected by Weather.

OVER 18,000 SOLD

	PRICE COMPLETE.
No. 0.—500 Candles, small hand pattern, for petroleum	£7 7 0
No. 1.—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ...	£10 0 0
No. 2.—1,500 Candles, useful and portable pattern	£15 10 0
No. 3. 2,500 Candles, Manchester Ship Canal pattern	£16 10 0
No. 4.—3,500 Candles. A most powerful lamp...	£17 15 0

These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

No. 50 "STANDARD" LAMP.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.

WELLS' STANDARD" OIL GAS LAMP NO 50

WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints. Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...	16/-	each.
„ Double „ ...	19/-	„
Tripod Stands	3/-	„
Extra Burners	2/-	„

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

LONDON, N.W.

WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

No. 1 Painter (as above Illustration) ...	£25 0 0
No. 2 „	£30 0 0
No. 3 „	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS,

Paint Holder and Sprayer Combined.

Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c., or any class of painting where the work is not very heavy or continuous.

Price, Complete £16

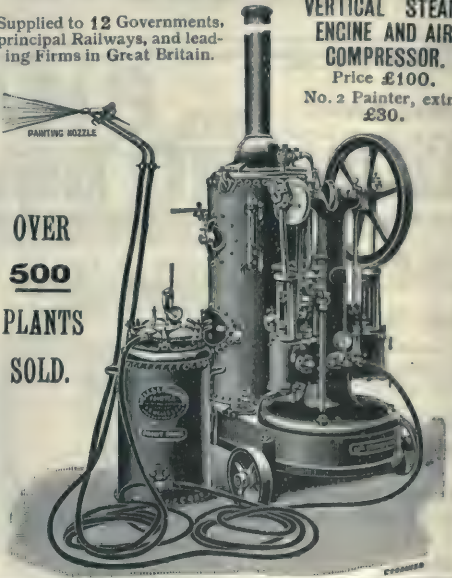
Hand Sprayer and Hose supplied separately, **£9.**

Supplied to **12** Governments, principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price £100.

No. 2 Painter, extra £30.



OVER **500** PLANTS SOLD.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
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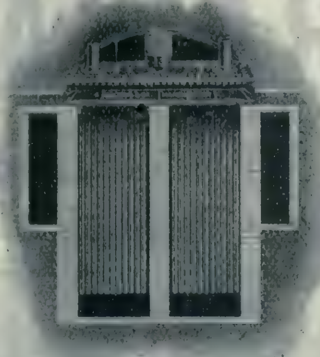

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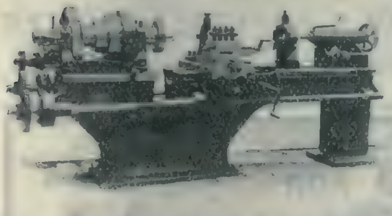

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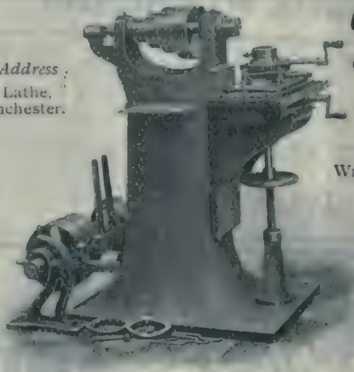

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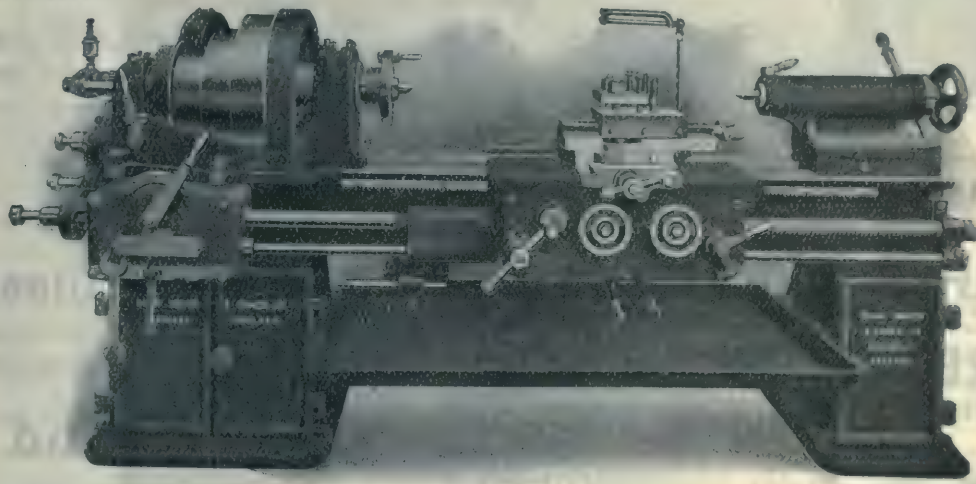

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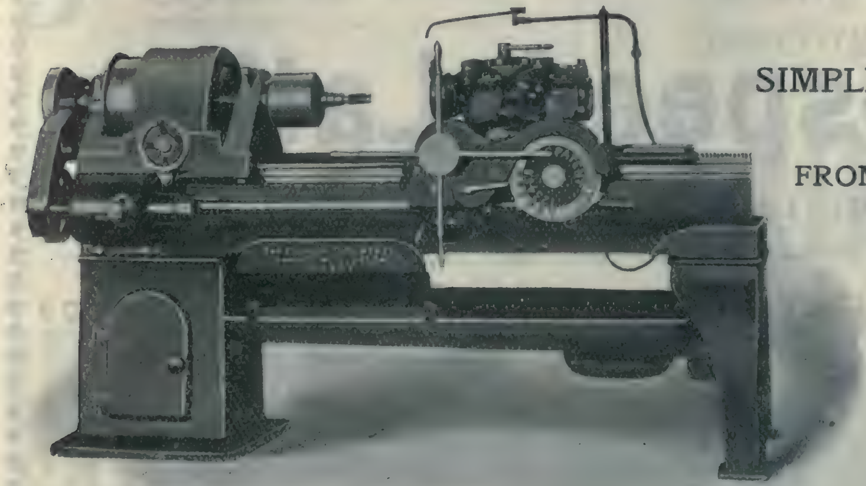

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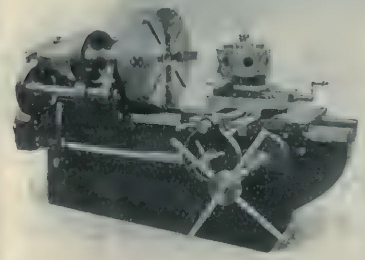

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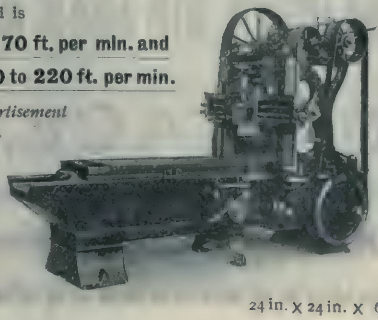

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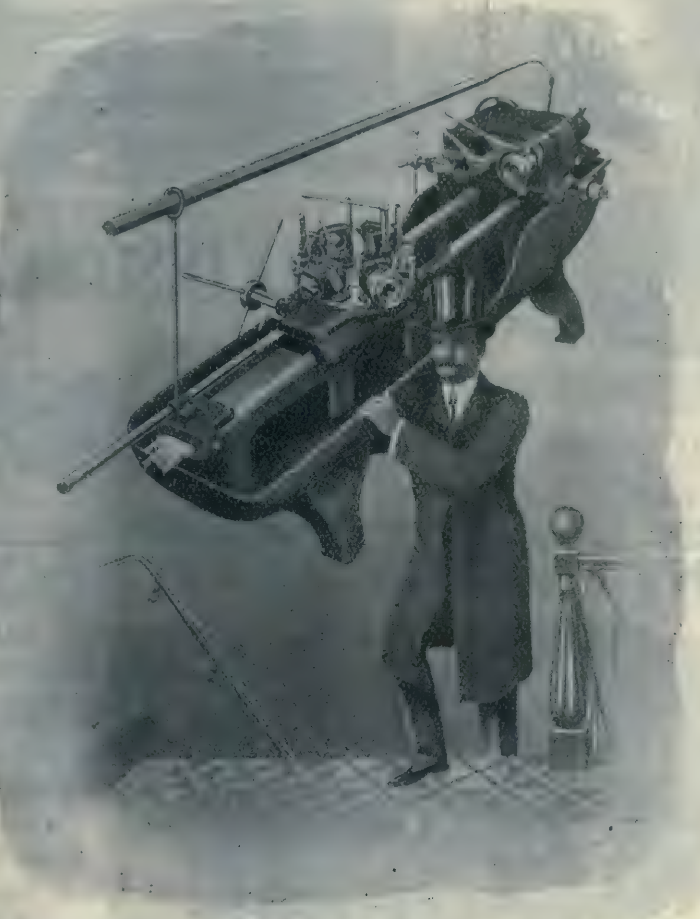

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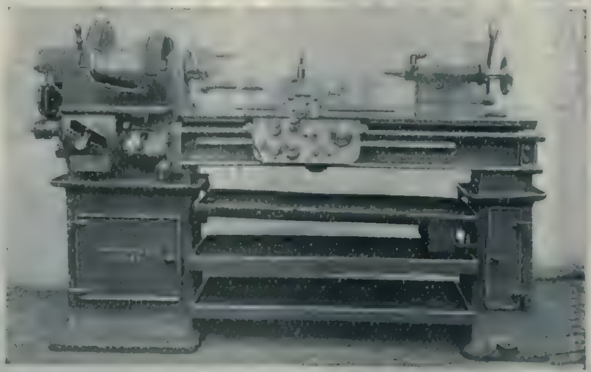

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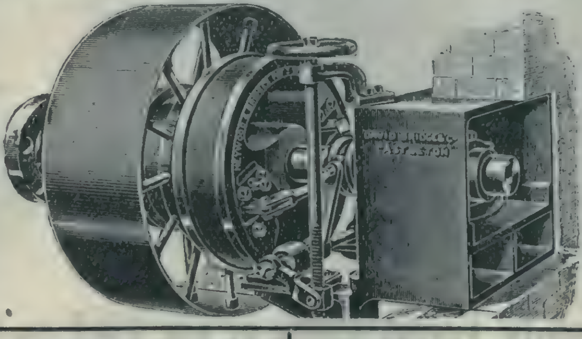

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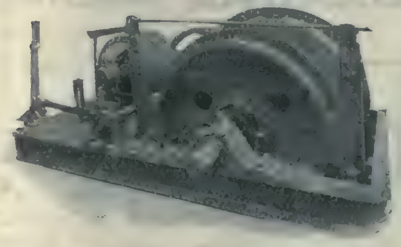

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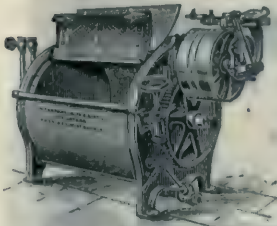

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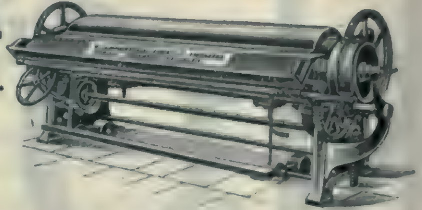

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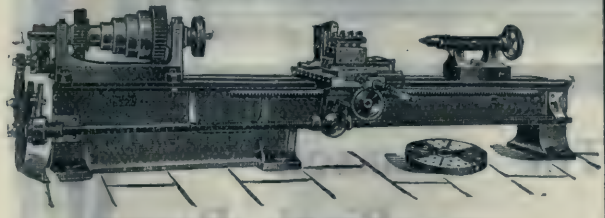

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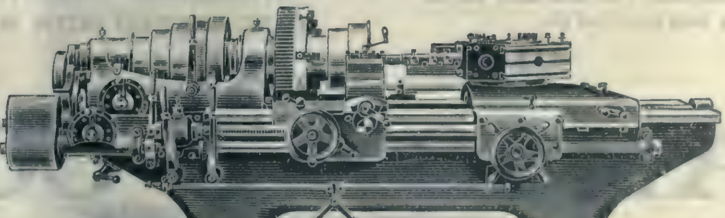

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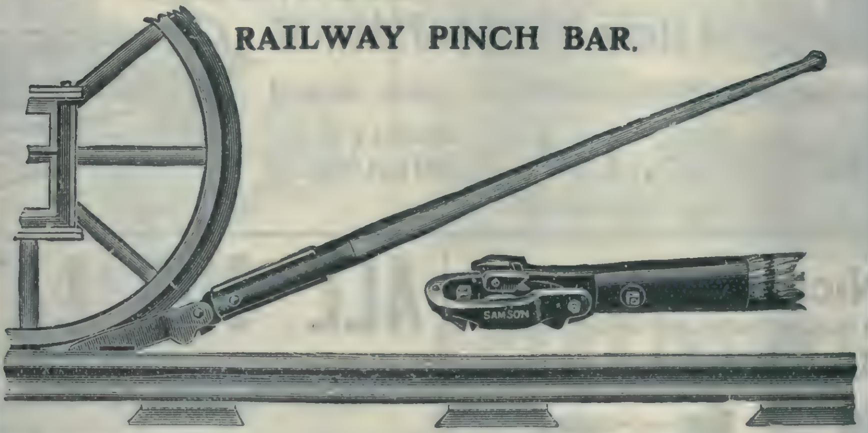

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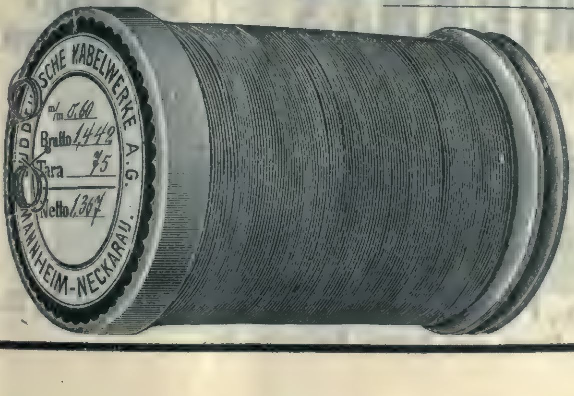

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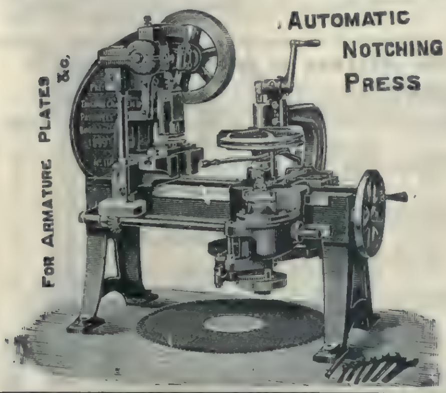

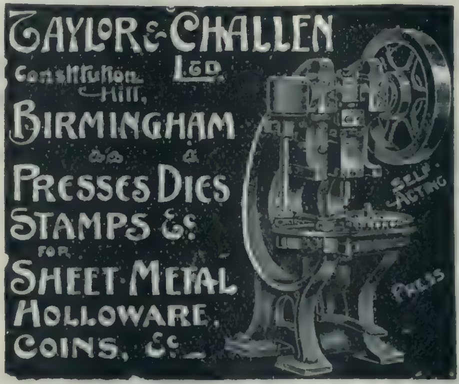
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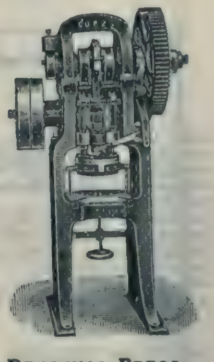
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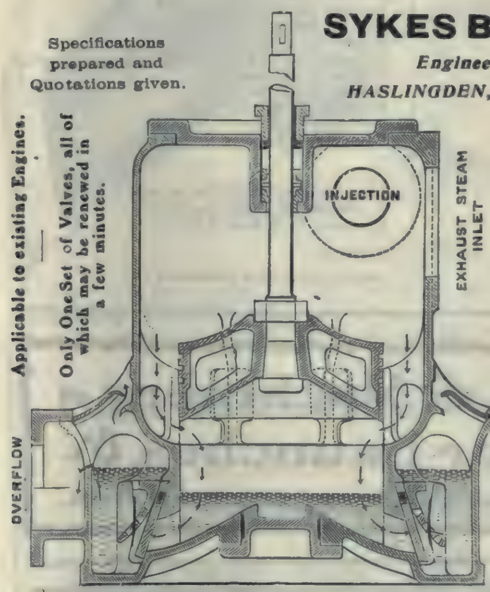

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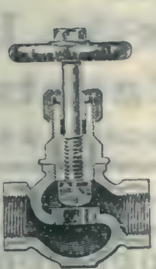

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VII. LONDON, FRIDAY, AUGUST 25, 1905. No. 50.

The Offices of "Page's Weekly," Wednesday Evening.

THE Russian Peace Commissioner, de Witte, who is generally considered the ablest man in Russia, was a railway man and rose to his prominent position through the railway service. The facts of the great statesman's career are succinctly stated by the Railway and Engineering Review. At the time of the Russo-Turkish war he was traffic manager on one of the private lines. The excellent service rendered in that capacity attracted the Government's attention to him. It is stated, with what historical accuracy is not known, that he held a train conveying a high dignitary on a side track while he gave the right of way to provision trains carrying supplies when they were critically needed. His discharge was demanded and given; but he appealed to the Czar Alexander, who not only approved his action but appointed him to an important position in the railway ministry. His promotion from time to time was not due to favouritism, but to force of character. In 1888 he became head of the railway department, then minister of railways, chairman of the tariff commission, minister of finance, and finally imperial chancellor. Born in 1849, in Transcaucasia, his beginning was of the humblest nature, his father being a Dutch storekeeper in Tiflis. M. de Witte retains his fondness for railway business and is said to keep up his interest in all the small details of railway operation.

Very complete facilities have been prepared at Portsmouth, N.H., for handling the telegraph and telephone messages in connection with the Peace Conference by the Western Union Telegraph Company, the Postal Telegraph-Cable Company and the New England Telephone and Telegraph Company. The Electrical World and Engineer of New York states that both the Western Union and Postal

Photo, Elliott & Fry.

THE EARL OF MINTO, G.C.M.G.,

Late Governor-General of Canada, who has been appointed Viceroy of India in succession to Lord Curzon.

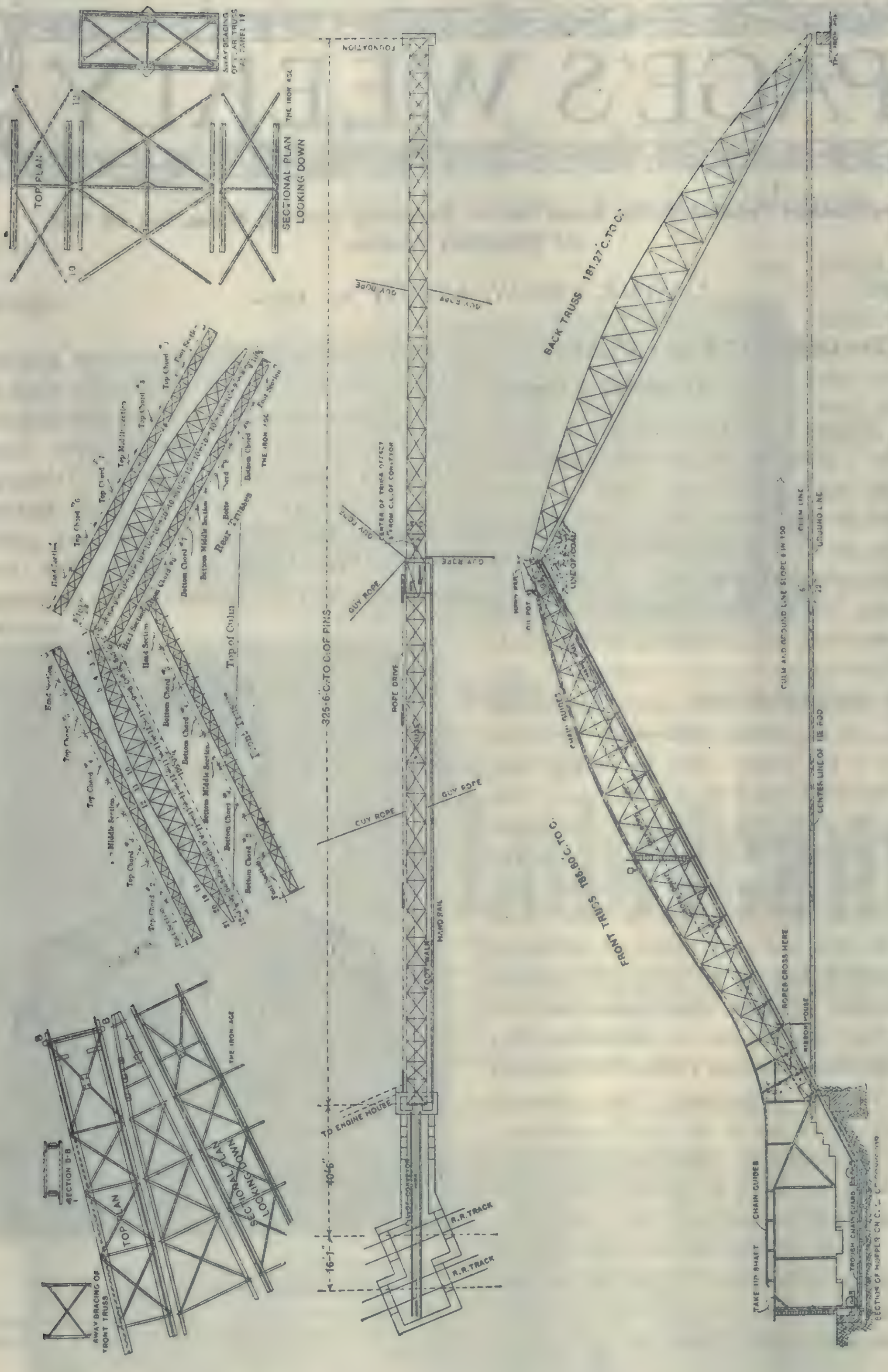

FIG. 2. PLAN, ELEVATION AND STRUCTURAL DETAILS OF ONE OF THE TRIMMING MACHINES EMPLOYED IN THE NEW PLANT OF THE PHILADELPHIA AND READING COAL AND IRON, COMPANY. (*See page* 409.)

Companies have established auxiliary telegraph and cable offices at the Hotel Wentworth, Newcastle, the hostelry which will receive the envoys as guests. The Western Union office is equipped with four quadruplexes, three duplexes and eleven single loops, besides special private loops in the Japanese and Russian suites, where direct communication will be maintained with the Atlantic cables at Heart's Content, Newfoundland via Canso, and also with the Western Union offices in New York, whence the Japanese diplomatic matter will be sent via land lines to San Francisco over a direct circuit. This circuit will be maintained during the night and early morning hours via Chicago, Omaha and Ogden, Utah. From San Francisco messages will be transmitted via the Pacific cable through Honolulu, Midway, Guam, Manila and Hong Kong to Japan. Facilities for the work of twenty-five extra operators are available at the Hotel Wentworth, which is connected by direct wire with the Halifax-Rye Beach cable station at Rye Beach, N.H., as well as with the land lines of the Western Union Company. The bulk of the Western Union work will be focussed upon the company's main offices at Daniel Street, Portsmouth, which are connected with the Hotel Wentworth by a temporary aerial cable of nineteen wires. An extra office, largely for the use of newspaper correspondents, has been set up in the Elk's Hall opposite the main office in Daniel Street. About 1,500 cells of gravity battery are installed in this building and twenty-five extra operators can be put at work, if necessary, besides fifteen operators in the main office. Two special circuits for the use of the envoys and their staffs have also been installed between the Portsmouth Navy Yard and the main office.

The Postal Telegraph Cable Company's arrangements correspond closely to those made by the Western Union. An auxiliary office at the Wentworth, with four quadruplexes, three duplexes, ten single loops and private loops to the envoys' suites is installed, the hotel being connected with the main office on Congress Street, Portsmouth, by a 22-wire aerial cable about 3½ miles in length. All the Wentworth service is looped through this main office, which is connected by direct wires with the Postal and Commercial Cable offices in New York. Russian messages will probably pass via the Commercial cables through Canso, and Japanese via the Postal Telegraph land lines to San Francisco and thence via the Pacific cable, which the Company controls, to Hong Kong and Japan. In the main office at Portsmouth, under Manager G. E. Morrill, tables with writing facilities have been prepared for the convenience of dispatch senders, and this office contains the company's famous "portable quads," which are transported from place to place in order to meet emergency calls, and also three 1-16 kilowatt portable dynamos mounted on boxes equipped with rollers. These dynamos are supplied with 125-volt direct current from the Rockingham County Light and Power Company's station in Portsmouth, and are designed for 115 volts primary and 380 volts secondary current. Fifty extra operators can be accommodated, if necessary, at the postal offices, and two navy yard circuits are also in place for postal service.

It is impossible to observe the streams of people who flock daily to the newly-opened exhibition of New South Wales products at the Guildhall, without arriving at the conclusion that a percentage of the crowd will be magnetised by the wealth of the Colony and emigrate. Here, in the heart of the city, where men are literally elbowing one another in order to obtain walking or standing room, is dumped a concrete example of what New South Wales can produce in the animal, vegetable and mineral kingdoms, and we are assured that the pressing need of the Colony is more men to develop her resources. Nearly half-a-million persons emigrate from Great Britain yearly, while scarcely 1 per cent. go to Australia. The exhibition at the Guildhall serves to punctuate the obvious inquiry—Why?

In seconding a vote of thanks to Sir George Faudel-Phillips, who opened the exhibition, Mr. T. A. Coghlan, Agent-General for New South Wales, said the Australian Colonies had no desire to trade outside the Empire. Their sympathies were entirely with the mother country, and they thought foreign nations had already trenched unduly on a trade that should belong to England. He hoped other Australian States would organise displays of their products in London. Above all it was the desire of the Australian people that the exhibition should be taken as an invitation to British manufacturers and merchants to organise displays of their produce to be shown in the chief cities of Australia, so that Australians might know that the mother country was able to supply the bulk of the goods which they now purchased from Germany, the United States, and other countries. Most of such goods could be supplied by Britain, and would be so supplied if British merchants were more alert. Only a few years ago all the great lines of steamers trading between Europe and Australia sailed under the British flag. Now that was no longer so, and the change represented the loss of several millions annually to the British shipowners. In conclusion, he read a cable message from the Premier of New South Wales thanking Sir George Faudel-Phillips for the interest he had taken in the exhibition, and hoping it would lead to increased immigration of men of British race to help New South Wales in developing its resources.

Prominence is naturally given to the mineral products of the Colony, and there are some particularly interesting examples of auriferous quartz from the principal reefs and formations in the State, carrying gold at the rate of from one ounce to thirty ounces per ton. A collection of nuggets, including the Maitland Bar of pure gold, valued at £1,236, and a number of minor exhibits, is arranged in the centre in a glass case and is jealously guarded by one of the Metropolitan Police. We are reminded that since the discovery of payable fields in New South Wales, gold to the value of £52,500,000 has been produced. The total gold-bearing formations extend over 70,000 square miles of the State. There are many instructive ore and mineral exhibits including silver, copper, tin, iron, coal, coke, kerosene, shale, and miscellaneous minerals. Since 1882, when the silver fields of the Barrier Ranges and Broken Hill, extending over 2,500 square miles, were discovered, silver and silver-lead ore to the value of £38,000,000 have been won. The annual output now exceeds £2,000,000. The area of New South Wales over which coal is distributed has been computed at 23,950 square miles. The annual output is at present 6,000,000 tons.

It was always hoped that with British rule in the Transvaal, other industries than gold mining would come into being, and it is satisfactory to learn, on good authority, that a movement is on foot at Johannesburg to initiate the manufacture of iron and steel. Local conditions are said to be such that the enterprise can be started with every prospect of success. It is stated that scrap can be obtained at the very low price of £1 per ton, and in sufficient quantities to keep mills going for some years or at least until such time as the Colony can manufacture its own pig-iron. To manufacture pig-iron, however, is evidently not an absolute necessity, as according to the prospectus, it is estimated that the yearly accumulation of scrap in the Transvaal is almost sufficient to supply the requirements of the works on the estimated output.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

The United States Metallic Packing Company, Ltd., of Soho Works, Bradford, have opened a London office at 17, Victoria Street, W.C.

The output of gold from Rhodesia for July was 34,693 oz. Other metals produced were as under: silver, 7,419 oz.; lead, 47 tons; coal, 7,937 tons.

Messrs. Armstrong, Whitworth, and Co., are said to be about to establish a new measured mile on the coast near St. Abb's Head. This is intended primarily for the trial of warships.

A commencement has been made in the dredging of a new pass at the entrance of the Harbour at Alexandria in order to afford ingress to large liners. The British Admiralty dredger St. Lawrence, assisted by one or two minor dredgers, is engaged on the work, which involves dredging a passage 37 ft. in depth, 600 ft. in width, and a fraction over half a mile in length.

The North-Eastern Railway Company have decided that, in order to improve the shipping facilities at the Hartlepools, it is desirable to construct a new entrance to the docks. This is to be made at the east side of the existing entrance, and it will be capable of dealing with vessels up to 70 feet beam. They have also sanctioned the removal of a large portion of the quay near the Hartlepools Dock offices, thus adding considerably to the width of the harbour and making navigation safer.

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Recent Machine Tools.

We illustrate herewith two useful machine tools designed by Messrs. Noble and Dund, Ltd., of Felling-on-Tyne. Fig. 1 shows a special 18-in. centre lathe for use with high-speed tool steel. The following is a general description of the machine: The lathe is capable of taking heavy cuts at high speed and with a coarse feed. The driving headstock is specially geared, with the driving cone on a shaft parallel with the main spindle, and gearing direct into an internal-toothed wheel at the back of the chuck plate.

The spindle is of forged steel. A large collar is forged solid with the spindle, and to this collar the chuck plate is firmly secured by turned steel bolts. The driving cone has five speeds of large diameters, and very wide for broad belts. The chuck plate is made very strong to carry heavy weights without straining, and is fitted with four wrought-iron gripping jaws; these jaws being removable from the face of the chuck without removing the screws by which they are operated. The saddle is fitted with two tool rests—one in back and one in front. The front rest only is made to swivel for taper work. The tools are self-acting in the sliding and surfacing cuts by means of back shaft, and for screw cutting by steel guide screw and change wheels. A complete set of twenty-two change wheels is supplied for screw cutting, all having machine-cut teeth. Overhead driving gear is provided, consisting of two brackets, counter cone and shaft, fast and loose pulleys, belt bar, and fork.

The approximate weight of the lathe is fifteen tons. Its chief dimensions are: Height of centres, 18 in.; admit between centres, 18 ft. 3 in.; width over bed, 2 ft. 4 in.; diameter of spindle, front bearing, 7 in.; diameter of spindle, back bearing, 4½ in.; diameter of chuck plate. 5 ft.; diameter of loose head spindle, 4½ in.; largest diameter that will swing over saddle, 2 ft. 4 in.; diameters of driving cone, 30 in., 26¼ in., 22½ in., 18¾ in., and 15 in.

The machine shown in fig. 2 is specially designed for boring propellers, and is adapted for general work of a heavy character. The spindle is of large diameter and has a self-acing vertical feed motion, and can be raised or lowered quickly by power motion. It is powerfully geared, being driven by a four-speeded cone, and there is a change of gear which gives a range of eight different speeds. The spindle is balanced by a counter-weight, which is placed inside the column.

The vertical thrust is taken by ball bearings working on hard steel surfaces. The overhead driving gear consists of two brackets, countershaft and cone, fast and loose pulleys, belt bar, and fork.

The chief dimensions and approximate weight of the machine are: Diameter of spindle, 7 in.; traverse, 3 ft.; distance from end of spindle to base-plate, 5 ft.; distance from centre of spindle to front of column, 3 ft. 11 in.; overall dimensions of base-plate, 12 ft. 6 in. by 6 ft.; diameters of driving cone, 25 in., 21½ in., 19 in., 16½ in.; width of speeds, 5¼ in.; diameter and width of fast and loose pulleys, 24 in. by 5½ in.; approximate weight, 13 tons.

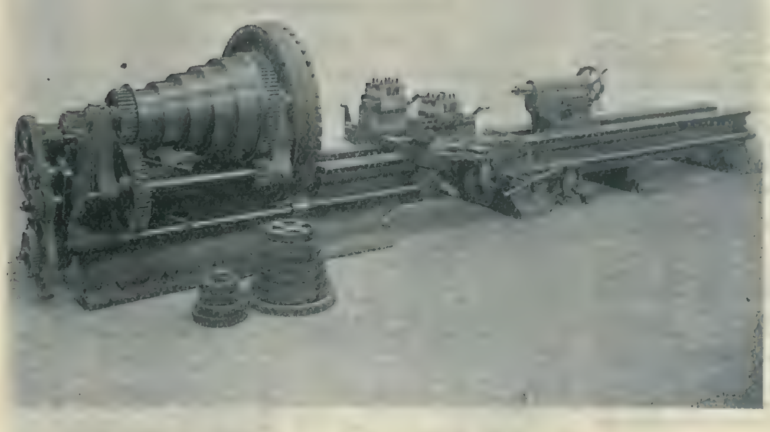


FIG. 1. 18-IN. CENTRE LATHE, FOR USE WITH HIGH-SPEED TOOL STEEL.

Public Works at Southend.

The pier and foreshore accounts of the Southend Corporation for the past year show a gross profit of £10,931, enabling £4,000 to be used for the relief of the rates. On the electricity undertaking a gross profit of £4,189 was made, but after meeting interet and instalments of loans, and writing off £73 for bad debts, there was a net loss of £732, as compared with a profit of £358 last year. The tram receipts showed a gross profit of £2,785, but after meeting interest and instalment of loans there was a net loss of £1,031. It has been decided by the town council to extend the tramways undertaking along the beach to Shoeburyness, and to build a sea wall and promenade, involving a total expenditure of about £67,000, less a contribution from the owner of part of the property.

Seaham and District Light Railway.

An inquiry has been held in the Londonderry Institute, Seaham Harbour, before Colonel G. F. O. Boughey, R.E., C.S.I., and Mr. Henry Allan Stewart, of the Light Railway Commission, as to the expediency of granting an application made to them for a provisional order to lay tramways from Ryhope to Seaham Harbour, Seaham Colliery, Murton Colliery, and South Hetton. This light railway will couple up with the tramways of the Sunderland District Electric Tramways at South Hetton and Ryhope, placing the above vast populous mining district in direct communication with Seaham Harbour and Sunderland.

Russian Railway Construction.

It will be noted that one of the duties of the proposed Russian State Council or Duma will be to deal with the construction of the railways by the State.

With a view to encouraging the investment of foreign capital in the development of the Russian railway system, a scheme affording considerable privileges to private enterprise has, says the "Standard," been formulated by the Committee of Ministers and approved by the Czar. The scheme provides for a Government guarantee of interest on debentures of companies working railways of importance to the State; the limitation of the Government share of profits of new lines; the extension of the period after which the Government has the option of purchase; the exemption of new lines from the cost of inspection and police protection; and various other mitigations of the somewhat stringent control at present exercised over private lines. Moreover a scale of payment for the conveyance of mails is to be drawn up.

Dredging the Thames.

Dredging operations in connection with the scheme of the Thames Conservancy Board for improving the bed and channel of the Thames between the Nore and Gravesend by forming a channel 30 ft. deep at low water and 1,000 ft. wide, now that the Bill empowering the work has received Royal assent, will shortly be commenced. The silt and sand on the Leigh middle shoals will be removed by suction dredging, and for the displacement of the ballast and similar material at Gravesend bucket dredging will be employed. The Thames Conservancy Board will acquire three new dredgers for the purpose.

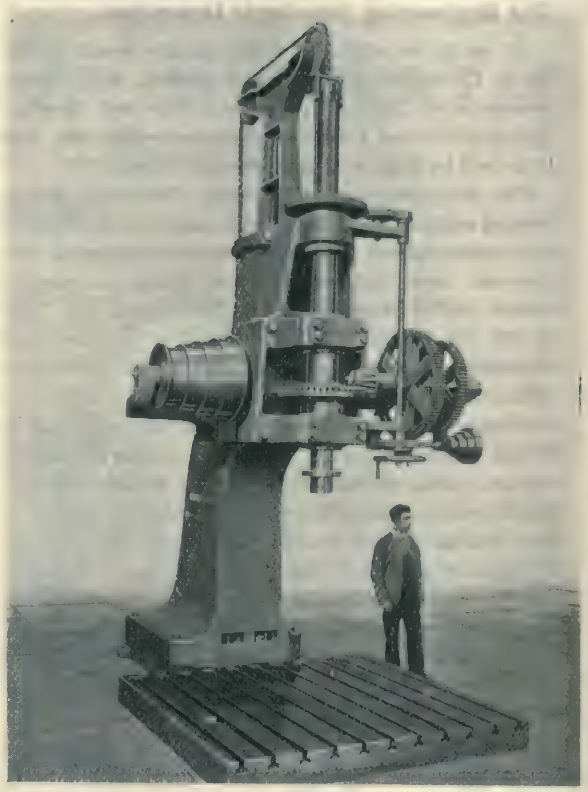


FIG 2. VERTICAL BORING MACHINE FOR BORING PROPELLERS, ETC.

The Avoidance of Trade Disputes.

At the annual dinner of the General Council of the Marine Engineers' Association held at Glasgow, the Lord Provost, who presided, referring to trade disputes, said he thought there was a method by which these recurrent disturbances of trade, involving loss on all hands—national loss—might be avoided. To his mind, the solution of these difficulties lay in courts of conciliation and arbitration. In the coal industry they found a conciliation board working with success, and he was sufficiently confident in the good sense of the working man and equally confident in the employers, that if this subject was brought more to the fore we might, almost in the immediate future, see a wiser resort to these boards of conciliation and arbitration. This would avoid disturbances which were far-reaching in their consequences, and which put the whole machinery and gear of commerce into partial chaos.

Mr. George Bray, gas engineer, of Leeds, who invented the regulator fishtail gas-burner, used in many countries for gas-lighting purposes, has died at Headingley at the age of 64.

The Engineering Standards Committee.

As we go to press, the latest reports issued by the above Committee are to hand, dealing with British Standards for Trolley Groove and Wire and Standard Specifications and Tables for Telegraph Material. The latter will be dealt with in a subsequent issue.

The Sub-Committee on Electric Tramways are at present engaged upon the several questions involved in the standardisation of electrical tramway material. As, however, some time must elapse before a complete report can be presented to the Electrical Plant Committee for adoption and transmission to the Main Committee, it has been deemed advisable, in the interests of the electrical tramway industry, not to delay the publication of their recommendations with reference to trolley groove and wire. Having carefully considered the information so courteously placed at their disposal, the Sub-Committee on Electric Tramways have come to the conclusion that no attempt should be made to standardise any particular design or shape of trolley wheel. They have, therefore, confined themselves to recommending a groove of a certain section, and, at the same time, desire to point out that in recommending this section as standard they are not restricting engineers to the use of any particular design of wheel, but rather suggesting that the overhead work be so arranged as to permit the standard trolley wheel groove being employed.

With regard to trolley wire, it has not been deemed advisable to go further in the direction of standardisation than the recommendation of certain figures for the minimum tensile breaking strength for the gauges of wire in general use.

The Sub-Committee by whom the Standards for Electric Tramway Material are being drawn up consists of Messrs. A. P. Trotter (Chairman), F. C. Armstrong, John Burbridge, Philip Dawson, F. Forbes Higginson, E. R. Hill, J. H. Rider, H. M. Sayers, A. M. Sillar, J. J. Steinitz, and A. H. Walton. Leslie S. Robertson, M.Inst,C.E. (Secretary). C. Le Maistre, A.M.Inst.E.E. (Electrical Assistant Secretary).

The following are the dimensions recommended as the section of the Standard Trolley Wheel Grove: Width in inches 1⅜ in., depth ¾ in., radius $\frac{7}{32}$ in., angle in degrees 65 deg. The figures recommended as the minimum tensile breaking strengths, in tons per square inch, for Standard Trolley Wire are: up to and including 00. S.W.G. not ess than 24; above 00. S.W.G. not less than 22.

An electrically driven oil boat 245 ft. long, 32 ft. broad, and rated at 1,100 tons, has been built for the Russian oil rad. She uses three Diesel oil engines for the production of power, which is transmitted electrically to motors operating the propellers.

The yield of gold in Victoria for the last seven months amounted to 436,079 oz.

Venezuela is said to have placed orders in Europe for war material to the amount of 25,000,000 dollars.

The first section of the new Glasgow Technical College has been completed, and will shortly be occupied.

The world's output of tin in 1904 was 92,243 tons, being a decrease of over 1,600 tons as compared with 1903. It is said that during the last few years the production of tin has not been equal to the demand.

A Big Railway Contract.

According to the Glasgow Herald's Montreal Correspondent the National Construction Company of Montreal, which is entirely composed of Canadian capitalists, has been awarded the contract for the construction of the Grand Trunk Pacific's new line between Winnipeg and the Pacific terminus. The company is now subletting the contract in sections under time limits for completion, and it is expected that the entire line will be put through in record time.

President Roosevelt and the Submarine.

The Daily Telegraph's New York Correspondent reports that tests have been made with the American submarine *Plunger*, which proceeded to Oyster Bay, Long Island, President Roosevelt having announced his intention of inspecting the crew, and subsequently making a submarine trip. Considerable pressure is being brought to bear upon the President urging him to forego submarine experiments, but it is not expected that it will be successful. Mr. Roosevelt has always taken the deepest interest in naval equipment, and particularly in submarines, which he believes have a great future.

The *Plunger's* officers say that their craft is "absolutely safe." By placing big eye-bars fore and aft provision has been made for raising the *Plunger* in case she should become disabled while below, as it will be possible to attach hooks to the bars and bring the craft up. The placing of the bars was the outcome of the lesson taught by the recent disaster to the submarine *Farfadet*. There was nothing on the French boat to which chains could be attached.

It has been urged that the President of the United States has no right to take any such risks as is involved in a descent in a submarine, even though the risk be slight. Our readers will recall the fact that only recently M. Thomson, the French Minister of Marine, descended in a submarine after the *Farfadet* disaster, and it was scarcely to be expected that a man of President Roosevelt's antecedents would allow squeamish objectors to prevent his performing a similar feat.

A NEW INSTRUMENT FOR THE MEASUREMENT OF ALTERNATING CURRENTS.

By E. F. Northrup.

THE instrument and methods of measurement here described were developed to meet the frequent need of means for easily and accurately calibrating alternating-current instruments, ammeters, and voltmeters, whatever their capacity; also to suggest an inexpensive method of measuring with high precision very large alternating currents, regardless of their wave form or frequency. Incidentally, the instrument and methods should prove sufficient for the accurate measurement of currents of very high frequency where ordinary methods would not be applicable. A further object kept in mind was to make it possible to utilise an installation of a direct-current potentiometer outfit, to measure alternating currents and pressures with nearly equal facility and precision.

The instrument and the methods of using it have been successful, because the following important features have been realised: (a) it is used as a zero instrument, and does not depend upon any calibration or determination of any constant of the instrument; (b) it operates with extreme sensitiveness, and being perfectly "dead-beat" is adapted to work with fluctuating currents; (c) it may be used with or without low-resistance shunts—when used with them, it has an unlimited upward range of current measurement, and when used without them, its lower range is down to from two to five milliamperes; (d) as the operation of the instrument depends upon the heating effect of currents, it is wholly independent of wave-form and frequency.

DESCRIPTION OF THE INSTRUMENT.

Referring to Fig. 1, two small wires, A B, of No. 33 hard drawn silver wire when shunts are used, lie parallel to each other at a distance of 0·158 in., being held near their extremities by ivory clamps, C C. Each of the ends of the two wires are connected to binding posts through the medium of heavy leads and soldered joints.

One face of a small circular disc of ivory, D, rests against the two wires at their middle point, a 0·5-in circular mirror being fastened to the other face. Fastened at the centre of the ivory disc, and half way between the wires, when the disc is in position on the wires, is a small hook. To this, through the medium of a thread, is fastened a small adjustable spiral spring. The small ivory disc maintains its position by friction and the tension of the spring. The wires bend back under the tension of the spring about 0·875 in. from the vertical. The ivory disc does not rest directly upon the wires, but bears upon each wire through the medium of a small agate stud shaped like the head of a screw, each wire being in the slot of the agate stud which rests upon it.

The two ivory clamps holding the wires near their upper extremity are made separately adjustable in a vertical direction by means of thumb-screws which pass through the hard-rubber top of the instrument. Springs *s s* prevent lost motion when the ivory clamps are screwed up or down.

The arrangement of parts above described is supported by a brass frame and a circular hard-rubber top. This

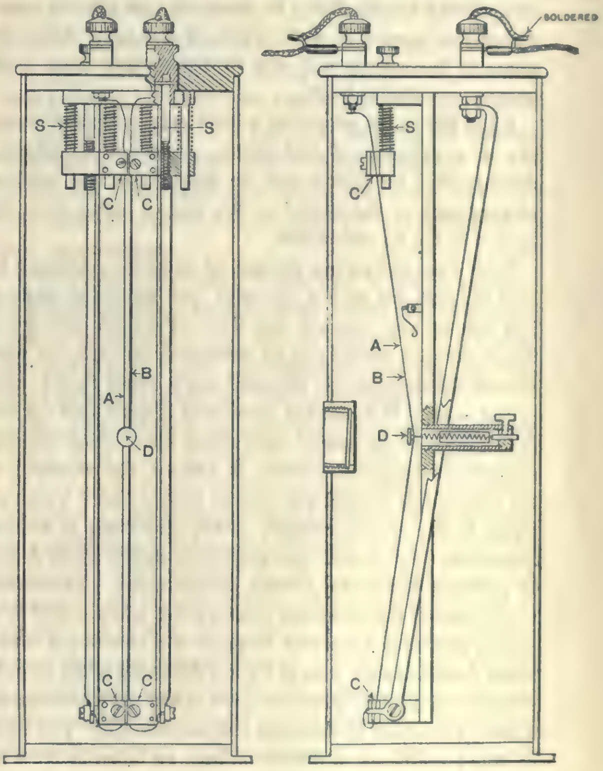


FIG 1.

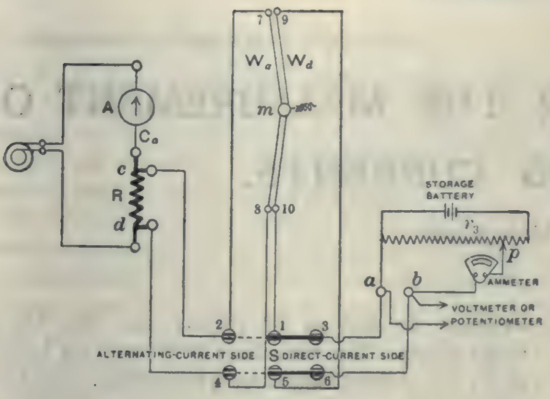


FIG. 2.

frame drops into a circular nickel-plated brass case. The case has a window in it directly in front of the mirror on the small ivory disk.

By means of the adjusting screws the tension of the two wires may be so adjusted that the plane of the mirror will be vertical to a line drawn in the direction of the spring which holds the mirror against the wires. Now if any elongation occurs in the wire on the right, that side of the mirror will be drawn down or back by the spring, or a deflection to the right is obtained. Likewise, if an elongation takes place in the wire on the left, the mirror will deflect to the left. If, however, an exactly equal elongation occurs in both wires at the same time, the plane of the mirror will not tilt but simply move back keeping parallel to itself.

If the mirror is observed with a telescope and scale, say at a distance of one metre, very minute angular deflections of the mirror will be easily observed, while a sinking back of the plane of the mirror away from the scale will not be observable.

Now if an alternating current of unknown strength be sent through the wire A, the wire will elongate, deflecting the mirror toward the left. Pass an adjustable direct current, which can be measured, through the wire B, until the deflection is reversed and brought back to zero on the scale. If when the deflection is zero, and certain precautions to be stated later have been observed, the strength of the direct current is known, the strength of the alternating current will also be known; for it is exactly equal to the direct current. This, however, is on the assumption that equal currents through the wires A and B produce equal elongations of the wires. Previously to comparing the currents, connect the wires A and B in series, and send a current through the circuit; if under these conditions the mirror be not deflected at all, or only slightly, it proves that the two wires are practically equally elongated by the same current strength, The limit of this possible small deflection may be taken as the true zero of the instrument. If this zero is maintained under working conditions, it means that the strength of the alternating current in the wire *A*, is equal to the strength of the adjustable and measured direct current in the wire *B*.

The instrument, however. if limited to such currents as could be passed directly through its wires, would have comparatively little value. We shall show how it may be used with shunts so as to measure alternating currents, however large.

ARRANGEMENT FOR MEASURING A LARGE ALTERNATING CURRENT.

The arrangement of the complete circuits for measuring a large alternating current for the purpose of calibrating an alternating current ammeter *A* is shown diagrammatically in Fig 2. An important accessory to the instrument is a quick-acting double-throw switch, marked *S* in the diagram. W_a and W_d represent the two wires of the instrument and *m* the mirror. R is a low resistance shunt, preferably of manganin, having a negligible temperature coefficient furnished with tap-off points *c* and *d*, between which the resistance R has previously been determined. The ammeter indicated tn the diagram will measure from one to two amperes of direct current; r_3 is a slide wire resistance, along which a slider *p* may be moved, thereby varying the pressure difference at *a-b* from zero to the value of the electromotive force of the storage battery.

The points a, b, on the direct-current side of the circuits have leads attached to them which go either to an accurately calibrated direct-current laboratory standard voltmeter, or to a potentiometer. It will appear later that except for the highest possible

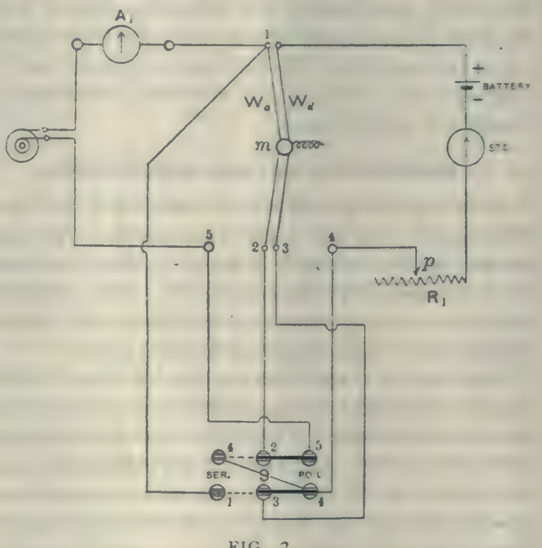


FIG. 3.

precision it is more convenient to employ the standard voltmeter, but assume for the present that a potentiometer is employed to give the potential difference between a and b.

When the instrument is installed, a permanent adjustment of the resistances, at any convenient temperature of the wires and leads, must be made as follows (see fig. 2):

The resistances, 9 to 10 = 7 to 8,
10 to 1 + 9 to 5 = 8 to 4 + 7 to 2 and
2 to c + 4 to d = 3 to a + 6 to b.

Thus, while this gives the overall resistance from a, through the wire W_d to b equal to the overall resistance from d through the wire W_a to c, the different portions of the circuit must be matched in resistance, as stated above.

It will be observed that if the switch S is closed on the alternating current side the two wires W_a and W_d are thrown in parallel, that the two parallel-connected circuits have the same resistance, by construction, and that to these parallel circuits at the points 2 and 4 is applied the same potential difference, this potential difference being the drop on the low resistance R carrying the alternating current. The drop over R, inasmuch as it is a low resistance, is only slightly lowered by being shunted by the two wires of the instrument and their leads, and this lowering of the potential is not appreciably greater when the two wires in parallel shunt the resistance R than when only one wire with its leads shunts this resistance. Disregarding the slight lowering of the potential, which, as will appear later, is of no consequence, we observe that both wires will now have passing through them equal currents, each current being nearly the same as would pass through the one wire W_a, if the switch S were open, and only this wire could receive current.

With the resistances of the parallel circuits correctly adjusted to equality both wires will get equal currents, both will elongate equally, or very nearly so, and the mirror m, instead of rotating will move back, maintaining its plane parallel to the position which it has with no current passing.

When the switch S is thrown to the direct current side, the potential drop over the resistance R is now applied to the wire W_a only; and the direct potential difference between the points a and b is applied to the wire W_d. This drop between a and b can be varied by the slider p and measured by a voltmeter or potentiometer applied at a, b. The ammeter gives the current taken by the wire W_d.

The shunt resistance R may be designed to carry any current, however large. The same resistance R, or a combination of resistances, may be designed with several tap-off or potential points, so that the instrument may always have approximately the same potential applied to its alternating current side, whatever the strength of the current to be measured. This potential drop is best made between 0·25 and 0·5 volt. The necessary drop of potential being so low, the energy dissipated in the shunts is small, and therefore they may be of very moderate size. It is also easy to make them practically non-inductive.

Consider now the circuits to be arranged as above described, and that a standard voltmeter is used, calibrated to give a full-scale deflection for about 0·75 volt, to indicate the direct potential between a and b. Then proceed to take measurements to calibrate the alternating current ammeter A (which may have any current carrying capacity whatever above one ampere), as follows:—

A shunt R and tap-off Points are first so placed that when the ammeter reads a full-scale deflection, the drop on the shunt R from c to d, varies from 0·25 to 0·6 of a volt, but preferably 0·5 of a volt. If the ammeter is known to read approximately correct, and since the value of R is known, we can gradually increase the current through the ammeter and shunt resistance until the proper potential drop is obtained; that is, the drop that will properly sensitise the alternating current instrument. If, however, the ammeter gives no guide to the true value of the current, the switch S may be left in its open position; the alternating current instrument can then be read as a deflection instrument. In this case the current through R should be increased until the alternating current instrument deflects to the end of the scale, when the drop over R will be about right for the condition of good sensitiveness.

The adjustment being made, the switch S is closed on the alternating current side, when the alternating current instrument will take a steady zero position; and if carefully made and adjusted, exactly the same zero position as when no current is passing.

The zero position is now carefully noted and the switch S is then thrown to the direct current side. The instrument will at once deflect until, by moving the slider p, the direct potential between a, b, balances the alternating potential between c, d, when the instrument will return to zero position. This adjustment can be made with great exactness, say to within $\frac{1}{25}$ per cent. The switch S may now be thrown across the alternating current and the direct current side alternately to prove that the adjustments have been correctly made; this will be the case if no permanent deflections result. The voltmeter is read, also the direct current ammeter and the alternating current ammeter A being calibrated. These readings give all the data for making a very exact calibration of one point on the scale of the ammeter under test. Other points on the scale may be similarly taken by varying the alternating current, and also the shunt resistance R. Inasmuch as, by varying this latter, we can read a small current with the same precision as a large one, the low points on the scale of the instrument under calibration can be determined with as great precision as the high points.

In practice the direct current ammeter is omitted A preliminary set of readings are taken to determine its indications corresponding to the different potentials that may be produced between a and b. With a given instrument and set of working wires and leads and voltmeter, the current in the circuit p b, fig. 2, is a function of the potential difference between a and b, This function may, therefore, be found by trial and plotted as a curve. This having been done, it only becomes necessary in calibrating an ammeter to take readings, in addition to the instrument being calibrated, of a voltmeter, and the zero position of the alternating current instrument. The expression which gives the value of the alternating current C through the ammeter A is

$$C_a = \frac{r - R}{r R} E + c = K E + f(E)$$

where r is the resistance of the voltmeter, R the value of the shunt used, E the potential read on the voltmeter, and c the current in the circuit p. K is a constant, and as ten values of R will cover all currents from 1 to 1,000 amperes, the values of K can be calculated once for all. Furthermore, by properly choosing the values of R, K can be made to assume the convenient values 10, 100, etc. f (E), the function of E, is readily taken from a curve and added to the product K E. f (E) is usually small compared with K E, and need not be accurately known.

MEASUREMENT OF SMALL CURRENTS.

For the measurements of small currents a modification in the connections and method of measurement is desirable. We have found the connections shown in fig. 3 to be most convenient for this purpose.

In this diagram A_1 is any alternating-current instrument to be calibrated that does not take more than 1·5 or 2 amperes, and Std. is any form of standard instrument that will accurately measure a small direct current. Now when the switch *S* is thrown to the side Ser., the wires *Wa* and *Wd* are so connected that the same current from the cell *B* will pass through them in series. This current may be regulated by the rheostat R_1. When the switch is thrown to the side *Pa'l* the alternating current will pass through the wire *Wa* and the direct current through the wire *Wd*.

With the switch in the position Ser. the differential zero of the instrument is noted. This zero, by careful construction and choosing of the working wires, may be made to differ not more than a fraction of a scale division from the no-current zero. The switch is now thrown to the position *Pa'l*, and the rheostat R_1 is adjusted until the instrument shows no deflection from the zero position found when the switch was in the position Ser. The switch may now be swung from side to side once or twice, the rheostat R_1 being more finely adjusted until there is not the slightest deflection. The value of the alternating current, that is the square root of its mean-square value, is now equal to the direct current as read by the standard instrument, Std. The accuracy of this comparison can be made very great If the alternating current is perfectly steady for a period sufficient to read the instruments, an accuracy of a $\frac{1}{25}$ of 1 per cent. is not too much to expect if the current being measured has a value which is such as to give the instrument a good sensitiveness.

If it is required to read very small currents, it becomes necessary to change the wires in the instrument, using finer wires suited to give the necessary sensitiveness, which is always obtained if, when passing the current to be measured through one wire only, the instrument gives nearly a full-scale deflection.

From a paper before the American Institute of Electrical Engineers.

THE BRITISH ASSOCIATION IN SOUTH AFRICA.

AS indicated in the programme which recently appeared in PAGE'S WEEKLY, an exceptionally interesting collection of papers has been prepared for the South African meeting of the British Association, though at the earlier meetings held at Cape Town, with the exception of the paper on Steam Turbines, contributed by Professor Biles, there has been little to record of strictly engineering interest. The total attendance at the meetings was fully 1,000, but the out-of-door attractions at Cape Town were responsible for meagre attendances in a number of the sections. Durban and Pietermaritzburg have provided busy halting places, and on Sunday the party will reach Johannesburg where numerous sectional meetings will be held, and among others the presidential address to the engineering section will be given by Colonel Sir C. Scott Moncrieff, K.C.S.I., K.C.M.G. The address will deal in a practical manner with the subject of irrigation and will be reported in the next issue of PAGE'S WEEKLY.

SOUTH AFRICAN RAILWAYS.

In the course of the Cape Town proceedings, Mr. John Jagger, member of the House of Assembly, read a paper on the railways in South Africa, and Mr. Tippett, gave a complete history of the Cape Government railways, of which he is chief engineer.

Sir W. H. Preece and Mr. Siemens both spoke in favour of the electrification of these railways, especially in the case of suburban lines. Local engineers explained the difficulties experienced in electrifying the railways owing to the narrow gauge.

DEGREES.

The following honorary degrees have been conferred at the University: Doctors of Science—Professor Darwin, President of the Association; Sir William Crookes, Past-President of the Association; Sir William Gill, the Astronomer-Royal; Professor Porter, of Montreal; Professor Davis, of Harvard University; Dr. Backlund, Director of the Nicholas Observatory, Pulkowa, Russia; Professor Bohr, Copenhagen; Professor Engler, Berlin; Professor Kapteyn, Groningen University; Professor Penck, Vienna; and Dr. Sjogren, Stockholm. Doctors of Literature—Dr. Murray, editor of the Oxford Dictionary, and Professor Codier, Paris.

NEED FOR PRACTICAL TRAINING.

In his address to the Educational Science section, Sir Richard Jebb remarked that among the developments of British intellectual life which marked the Victorian age, none was more remarkable, and none is more important to-day, than the rapid extension of a demand for University education, and the great increase in the number of institutions which supply it.

With reference to the provision made by the newer universities for studies bearing on practical life, it should be remarked that much has been done in the same direction by the two older universities also. At Cambridge, for example, degrees can be taken in economics, and associated branches of political science; in mechanism and applied mechanics; and in agricultural sciences. It certainly cannot now be said that the old universities neglect studies which are of direct utility, though they rightly insist that the basis and method of such studies shall be liberal. In looking back on the general course of this whole movement in England, we find that it has been steady, smooth, and fairly rapid. It has not been due to any spasmodic impulse or artificial propaganda, but has been the result of natural forces operating throughout the nation. Universities, and the training which they give, have come to count for more in our national life as a whole.

HIGHER EDUCATION IN SOUTH AFRICA.

Sir Richard Jebb mentioned that before leaving England, he had endeavoured to acquaint himself with at least the outlines of the general situation, with reference to the present position and prospects of the higher education in South Africa. In the first place, he thought it would be correct to say that in South Africa at large there was a genuine and a keen desire for efficient education of the highest type. A sound liberal education was desired for all who could profit by it, whatever their future callings were to be. But the practical and immediate need for the organising of the highest teaching was felt, he believed, more particularly in regard to three great professions—the profession of engineering, in all its branches; the profession of agriculture, including forestry; and the profession of education itself, on which the intellectual future of South Africa must so largely and directly depend. Unstinted gratitude was due also to the University of the Cape of Good Hope. The primary needs of daily life in a new country made demands for certain forms of higher training—demands which might be unable to wait for the development of anything so complex and costly as a teaching University. It was necessary to provide a training for men who would be able to supervise the building of houses, the making of roads, bridges, and railways, and to direct skilled labour in various useful arts and handicrafts. The first step in such a provision, said Sir Richard emphatically, is to establish technical schools and institutes.

THE ULTIMATE AIM.

In the course of subsequent observations on the aims of university training he remarked that wherever scientific and technical education attains its highest forms in institutions of University rank, the aim is not merely to form skilled craftsmen, but to produce men who can contribute to the advance of their respective sciences and arts, men who can originate and invent. There is a vast world-competition in scientific progress, on which industrial and commercial progress must ultimately depend; and it is of national importance for every country that it should have men who are not merely expert in things already known, but who can take their places in the forefront of the onward march.

In conclusion, he endorsed the opinion of Mr. E. B. Sargant, that the progress of education in all its grades, from the lowest to the highest, is the agency which, more surely than any other, will conduce to the prosperity and the unity of South Africa.

EDUCATION AT THE CAPE.

Contributing a paper on "The Difficulties and Development of Cape Education," the Rev. W. E. C. Clarke, M.A., said it seemed likely that the teaching University of the future would consist of certain constitutent colleges. The Rhodes scholarships, while benefiting the individual holders, would also further higher education if made post-graduation scholarships; in the original scheme they might have tended to do actual injury to higher education in the Colony. A school of mines was instituted at the South African College in 1896, and the students now completed their course at the Johannesburg Technical Institute. While the progress of education had thus proceeded satisfactorily along various lines, it could not be said that the position of the teacher had improved in a corresponding degree.

During a subsequent discussion in this section, Professor Ritchie advocated the establishment of a great teaching University at Cape Town as the best means of reconciling racial differences.

STEAM TURBINES AS APPLIED TO OCEAN LINERS.

Prof. J. Harvard Biles, presented an excellent résumé of the progress made in steam turbine propulsion, remarking that as the application of the turbine principle to all kinds of high speed steamers had now reached the practical stage, engineers had an opportunity of completely studying the relative efficiency of the new and old methods. He thought there was no doubt that when a proper adjustment of form area and pitch of propeller to the boiler power and the form of the ship had been reached the turbine system would prove an advance upon and indeed supersede the reciprocating engine for vessels of this class.

Incidentally, an instructive comparison was made of the Midland Railway's new steamers the *Londonderry and Manxman* turbine vessels and the *Antrim* and *Donegal* identical with them but fitted with reciprocating machinery. It was remarked that the *Londonderry* had turbine power sufficient to obtain the same speed as the vessels with reciprocating engines. The weight of machinery was less, and the saving in weight reduced the displacement and the resistance of the vessel so that the power for the desired speed was less. This advantage to the turbine showed in its first cost as well as in the cost of running, and it left the comparison with the reciprocating engine as one which included in favour of the turbine the incidental advantage due to its light weight.

One of the savings in weight in the *Londonderry* was in the boilers, which, though of the same size and number as the other vessels, had a reduced pressure of 150 lb. instead of 200 lb. In the case of the other turbine vessel, the *Manxman*, the same saving in weight was not made, but a more powerful turbine was put in, and the boiler pressure was not reduced as in the *Londonderry*. By this arrangement the greatest power which the boilers could give was obtained, regardless of the weight of the turbine, instead of, as in the other case, the smallest weight for a given power.

The net result was a maximum gain in speed of three-quarters of a knot, which, if the efficiency in the other two ships were the same was the equivalent of a gain of 14 per cent. of power when the extra resistance due to the extra weight was allowed for. It was difficult to determine how much of this gain was due to the turbines, as the propellers were different in the three ships, and probably had different efficiencies. But from the result of steam consumption observations, it appeared that at about the maximum speed of 22 knots of the *Londonderry*, the slower vessel, the extra power required was more, while the resistance was less, the net difference in efficiency of turbine and propeller being at least 12 per cent. in favour of the *Manxman*, the faster vessel.

If this gain in efficiency were maintained throughout to the full development of the *Manxman's* powers, there would only be a net increase of power developed in the turbine of less than 2 per cent. It was difficult to say whether the efficiency would or would not be maintained, and so one was left in doubt as to the relative efficiency of the larger turbines with the higher pressure, though it seemed probable that it was represented by a small percentage, about 2 per cent. As to the comparison between the turbines and the reciprocating engines and propellers combined their comparative efficiencies were at 20 knots speed, in the following ratios—*Antrim* ·97, *Londonderry* 1·0, and *Manxman* 1·11.

The results on service were more interesting commercially. It was difficult to eliminate effects of weather, tide, loading of vessels, and the other matters which affected results on service ; but a fair average could be obtained if sufficient observations were taken. The method of comparison adopted was to find from the logs all the voyages in which two chosen ships were running on the same night in opposite directions. Omitting from these all cases in which full speed was not maintained in the open sea for all the run, the following results were obtained :—

R—Reciprocating. T—Turbine.	Antrim. R.	Lon. T.	Lon. T.	Don. R.	Don R.	Man. T.	Man. T.	Antrim. R.
No. of trips	48	48	42	42	39	39	29	29
Average coal per trip ...	35·6	35·3	36·9	36·0	38·7	40·2	38·6	38·6
Average speed in knots...	19·7	19·5	19·8	19·2	19·3	20·3	20·3	19·5
Speed ... ... (Coal consumed)	10·9	10·76	10·62	10·24	9·59	10·25	10·67	9·85
Coal consumed per cent. in favour of	1·30	—	3·6	—	—	6·6	8·2	—
Mean per cent. in favour of turbines	Londonderry. 2·4				Manxman. 7·7			

This method of measuring efficiency by the ratio of the square of the speed to the coal consumed assumed that resistance varied as the square of the speed. If the actual water consumption curves were used the results at the same speed gave an average advantage of the *Manxman* over the two reciprocating engine vessels of 8·9 per cent. It would be seen that the advantage of the *Londonderry* over the *Antrim* on trial was 3 per cent., but that it changed to a disadvantage of 1·3 per cent. on service, making the *Antrim* 4·3 per cent. better on service relatively to the *Londonderry* than she was on trial. The similar figures *Antrim* and *Manxman* showed the latter to be 14 per cent. better on trial but only 8·2 per cent. on service—a gain for the *Antrim* of 5·8 per cent. as between trial and service conditions.

The efficiency on service seemed to be less marked in the turbine than it was on trial. It might be that with the increase of resistance due to sea, wind, and foul bottom the turbine propellers were less efficient relatively, as they were so small, but it was reported that in bad weather there was less racing in the turbines. Until careful water consumption tests were systematically carried out, the point would remain doubtful. It seemed certain, however, that 8 or 9 per cent. of gain might be relied upon if the turbines were as efficient as those of the *Manxman*. The weight of the *Manxman's* machinery, and the part of the hull lightened, turned out to be 115 tons less than the *Antrim*—a saving of 15 per cent. in the total weight of engines and boilers.

METAMORPHOSED BATTLESHIP.

The first-class battleship *Renown*, in which the Prince and Princess of Wales are to make their journey to India, is to be out of the dockyard hands at Portsmouth Dockyard by the first week in September. After undergoing trials the ship will proceed to Genoa, to embark the Prince and Princess and their suite on October 8th. Capt. the Hon. H. Tyrwhitt, now private secretary to the First Lord of the Admiralty, is to have command of the *Renown* during the voyage, and Commander Godfrey M. Paine, who is now in command of the *Renown*, will be the principal executive officer.

U.S. NAVAL ESTIMATES.

In his annual report for 1904, the Secretary of the United States Navy calls attention to the fact that while the naval estimates for the next fiscal year are the largest ever submitted, they are $17,000,000 less than the total of the estimates presented by the chiefs of the various bureaus, and call for less money than is actually required to continue the programme laid down by the Navy General Board. The Secretary also notes the interesting fact that last year was an important one, for the reason that it witnessed the launching by the United States of a larger number of warships than were ever put into the water by that or any other country during a similar period. The Navy last year cost the American people a little more than one dollar *per capita*.

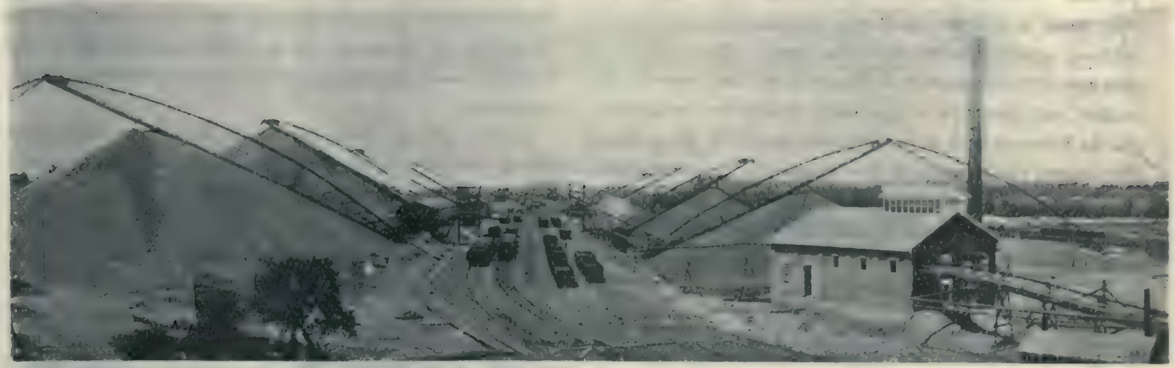


FIG. 1. GENERAL VIEW OF THE PLANT.

NEW PLANT OF THE PHILADELPHIA AND READING COAL AND IRON COMPANY.

THERE is illustrated on this and following pages the Bridgeport Transfer of the Philadelphia and Reading Coal and Iron Company located at Abrams, Pennsylvania, the material for which has been manufactured and installed by the Dodge Coal Storage Company, Nicetown, Philadelphia. The Dodge system was decided upon, and this system, as our readers are probably aware, admits of the stacking in great piles or trimming out of the coal to be stored and the reloading from storage for further transport, both operations being performed by continuous conveyors, while at the same time provision is made for screening the coal. The plant at Abrams, of which a general view is shown in fig. 1, consists of eight piles, each of a capacity of 60,000 tons, arranged on each side of a central gravity track system.

The guaranteed performance of the plant is given by the Iron Age, to which we are indebted for these details, as 1,800 tons per day of ten hours for each of the eight incline conveyors, or a total stocking out capacity of 14,400 tons per day. For replacing the coal on to cars each of the four reloading conveyors will have a capacity of 2,500 tons, making a total reloading capacity for the plant of 10,000 tons per day of ten hours.

In the operation of the Dodge system a chain conveyor supported by a sheer truss, constituting a trimming machine, is employed to stock out the coal, and a pivoted or swinging ground conveyor, consisting of a flighted chain suitably mounted on a steel frame and actuated by power in all its movements, is employed for reloading the stocked coal into cars. The sheer truss of each trimming machine is arranged to span the pile to be formed, and is fixed at or about the natural, angle of repose of the coal.

As usually arranged for open air storage on levelled ground, two trimming machines and one reloading machine located between them constitute a group, and the storage plant consists of the required number of these groups, which may be either of the same or of varied capacities. In the operation of the plant the coal received from cars in a hopper located beneath the receiving track is fed through a chute to the conveyor of the trimming machine, which delivers it upon the ground, or at the apex of the pile as it forms. The bottom of this conveyor is a steel ribbon, usually 12 in. wide, which is wound upon a drum located at the foot of the truss and arranged to be drawn out in grooves fixed in the conveyor trough so that its end, which is the only discharge point for the coal from the trimming machine, shall always be at the constantly rising and receding apex of the pile. With the trimmer building the pile up from the base in such a manner, the drop of the coal will not exceed 12 in. at any time throughout the entire operation. The breakage is thus reduced to the minimum. The reloading machine is composed of a horizontal and an inclined portion, both working together so as to render the carrying of the coal continuous from any point on the horizontal portion to the upper end of the inclined portion. Here a pocket is provided into which the coal flows, and from which it is discharged over shaking screens, and delivered into the cars. The horizontal portion of the reloader is pivoted at the foot of the incline, and provided with wheels, which run on circular tracks between and under the two heaps of the groups. The power mechanism of this apparatus is so arranged that one man on the operating platform handles the reloader with ease, taking coal automatically from the base of either of the two piles as may be required.

DETAILS OF THE PLANT.

As the reloading operation from the base of the pile proceeds slides or avalanches are frequent. These would overflow or bury the reloader were it allowed to await them. The operator stands ready by a turn of the wheel to swing the reloader away from the pile until the slide ceases. Then with a reverse turn he brings the machine again into contact with the pile. The coal is delivered from the pivotal reloader through a hopper into the reloading incline, thence to the reloading tower for discharge into the cars for reshipment. The reloading tower is equipped with screenings hopper, adjustable shaking screens, reloading chute and operating machinery. The tower is built directly over the dumping tracks with the track containing the screenings car to its rear and the reloading car in front of it. This permits all of the dumping and reloading processes to progress simultaneously.

As the ground area on which the plant is located is not perfectly level, there being a difference of grade between the four floors, the dimensions of the eighty piles vary slightly, the shear trusses being placed at different angles. The variations as to the total span of the trusses range from 345 ft. to 351 ft. The central track system is arranged in two sets, the tracks containing the screening cars being located nearest the piles on each side, while the dumping tracks come next and the reloading tracks, which can also be used at times for dumping, are in the centre of the system.

THE TRIMMING MACHINES.

In fig. 2 (page 394), the plan, elevation and details of one of the trimming machines are shown. The illustrations clearly demonstrate the character of the trusses, and the plan shows the location and angles at which the guy ropes are placed, as well as other details. The structural details shown in the upper

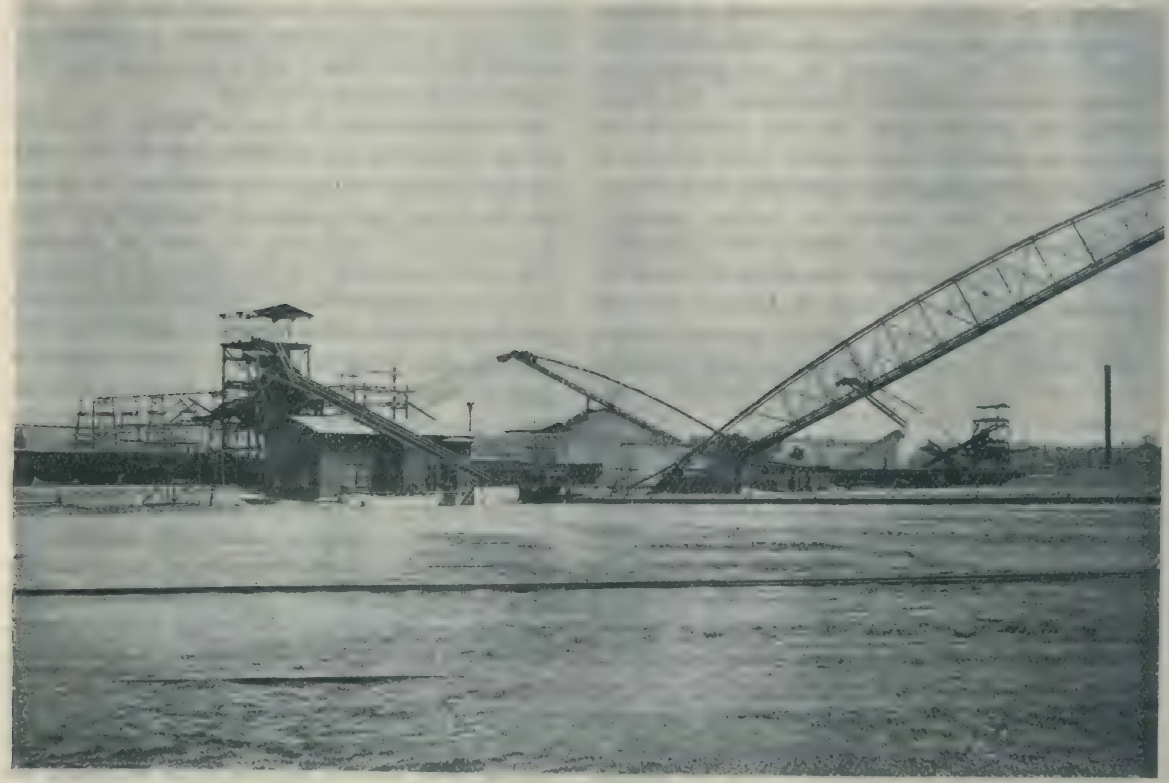


FIG. 3. SHOWING TRIMMERS WHICH STOCK THE COAL AND RELOADER.

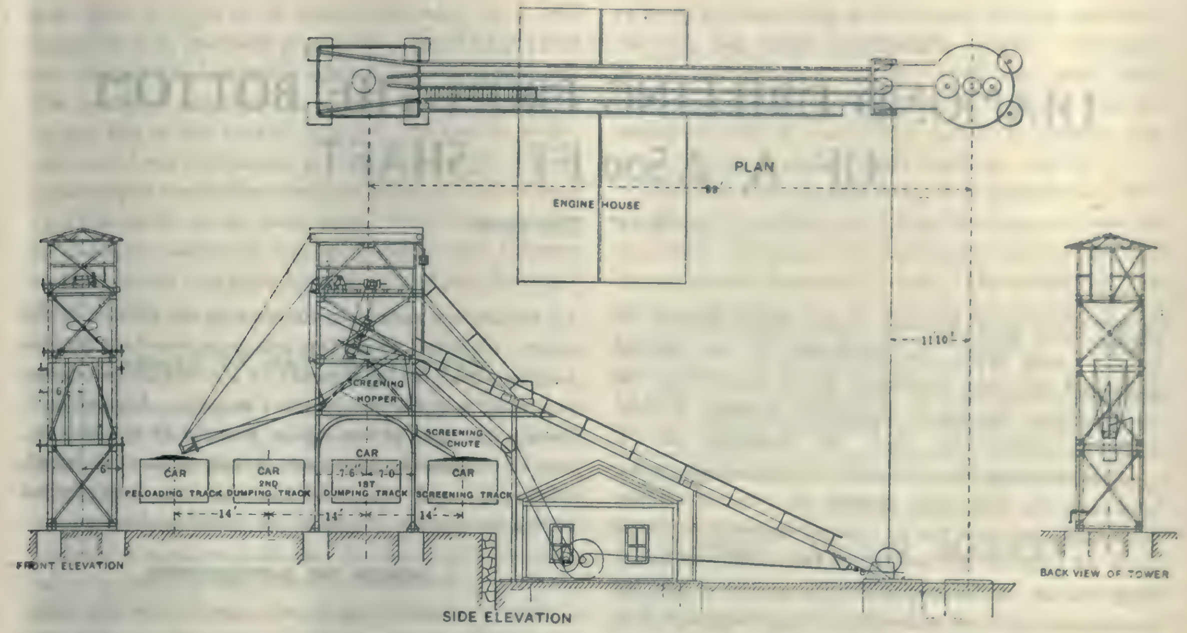


FIG. 4. ILLUSTRATING DETAILS OF RELOADING MACHINE.

left-hand corner represent typical sections of the end construction as used for the foot and head sections of the front truss. In the middle of the top of the engraving the form of bracing used in the trusses is shown. Sections in the upper right-hand corner illustrate the form of bracings used for the two centre panels, and also the sway bracing, which is located exactly in the middle of the truss. A very light but strong form of construction is obtained by using tees and angles, the former being employed where greater rigidity is desired. Where the principal members are joined together, particularly on the end sections, the holes are drilled with a steel jig, and slightly larger sized rivets are used. The sections at the extreme end are riveted complete in the shops. The illustration, fig. 3, gives a view of one of the trimming machines, showing the flight conveyor elevating the coal and on the top of the machine the conveyor on its return to the pit.

THE RELOADING MACHINE.

The reloading machine is shown in fig. 4. It will be noted that the sweep is built up of structural shapes, and is strongly braced by means of cross and lateral bracings. It is placed on wheels which rest on the circular rails placed underneath and between the piles, and in the case of the Abrams plant will be swung about from one angle to another electrically. Travelling around the outside of the structural form there is a continuous flight conveyor, which on its travel toward the pivot or stationary end is brought in contact with the edge of the coal pile, thus pulling the coal toward the incline, whence it is dropped into a hopper and elevated to the reloading tower. The length of each reloading sweep is 328 ft. 5 in. from the centre of pivot to its extreme farther end. At its middle sections it will be about 10 ft. wide, and it will be tapered to a width of 2 ft. at each end. For cross bracing, 12-in. channels weighing 30 lb. per foot are placed at distances of 7½ ft. apart., with the exception of the extreme ends where distances taper down to 2 ft. 6 in. The reloading tower and its incline are shown in fig. 4. As will be noted in figure, the reloading tower is to contain adjustable shaking screens. By reference to fig. 4 it will be observed that an engine house is located underneath the incline which contains the power plant for driving all of the machinery of the reloading apparatus. This machinery is operated from the sweep platform for bringing the coal up to the reloading tower, and all of the apparatus of the reloading tower is controlled by the operator stationed at the top of the tower. It will be noted that the coal is delivered directly to the shaking screen, where it is separated from the screenings, the latter falling into a hopper, whence it is conveyed by chute to the car upon the screenings track. The screened coal is lowered by means of the hinged chute to the car upon the reloading track.

DIAMOND DRILLING FROM THE BOTTOM OF A 2,500 FT. SHAFT.

By S. C. Thomson.

WHEN the Vogelstruis Deep stopped sinking the west shaft, the formation at the bottom indicated the close proximity of the south reef, and in May last the board authorised sinking a bore-hole to locate the reef. In deciding not to unwater the shaft, but to locate the drill on the surface and carry the rods down through the 5-in. air column, it was supposed that the air column extended to within 40 ft. to 50 ft. of the bottom of the shaft, and had it been known, as subsequently found out, that this distance was 95 ft., it is doubtful if the work would have been attempted, as it is readily seen that 95 ft. is a long distance for a 4-in. pipe ,to stand vertically without support except at the top and bottom. The plan decided upon for carrying out the work was as follows: To put 260 ft. of 4-in. pipe down through the air column to the bottom of the shaft to act as a continuous support for the drill-rods; secondly, to lower 2½-in. pipe with steel collar set with diamonds to revolve this and drill a sufficient distance to seat this pipe firmly and make a permanent guide for the drill-rods.

The first thing that had to be done was to cut through a fitting at the bottom of the 5-in. air-column to allow for the passage of the 4-in. pipe. A 4⅝-in. rose bit was slowly sent to the bottom, but, meeting with some resistance, it was necessary to revolve it, and in this way a considerable quantity of iron shavings and scale accumulated at the bottom and prevented this solid rose bit from reaching the fitting. A 2-in. star bit was substituted, and, after boring through the fitting and allowing the débris to pass through, the rose bit successfully removed the obstruction. A 4-in. extension pipe (strengthened at the lower end with 40 ft. of boiler tubing, all the couplings being turned in the lathe to 4⅝-in. diameter outside) was then lowered, the approximate weight being six and a half tons. The 4-in. pipe was freed from the drill-rods by means of a left-hand threaded socket. A 2-in. chopping bit, which was then lowered, was found to turn very hard near the bottom, and the drill-rods on being brought to the surface were found to be badly bent, indicating that the 4-in. pipe had been deflected by the uneven surface of the rock at the bottom of the shaft. In withdrawing this 4-in. pipe two of the bottom lengths broke off on account of the couplings coming in contact with the end of the 5-in. pipe. After straightening the pipe, it was again lowered to the bottom, but as it again became bent it was reduced in length to 223 ft., and 109 ft. of the end was strengthened with 4-in. tubing. A chisel bit was then lowered.

A SERIES OF DIFFICULTIES.

After reaching a depth of 2,510 ft. this bit broke off, and was recovered with a 2½-in. tap. It was estimated that there was still a deflection in the last 100 ft. of rods of 10 deg. However, it was decided to lower 400 ft. of 2½-in. pipe through the 5 in. and 4 in. and make a trial drill with "B" drill-rods. This 400 ft. of 2½-in. pipe had a bell-mouth fitting at the top to act as a guide for the drill-rods, and was lowered with a left-hand plug to prevent the rods from unscrewing when leaving it. After several attempts to seat the 2½-in. pipe by the use of a chopping-bit, the rods broke leaving the bit and 10 ft. of drill-rods at the bottom.

It was then decided that the angle of deflection was too great to permit of drilling, and the 2½-in. pipe was brought to the surface, leaving the chopping-bit and 10 ft. of rods inside the 4-in. pipe. Several attempts were made to raise the 4-in. pipe for the purpose of straightening it, but the deflection was too great to allow it to be pulled through the 5-in. pipe. At this point the only course open was to blast off the bent portion of the pipe in the hope that the remainder of the pipe would slide through the 5-in. pipe and reach the bottom of the shaft in a vertical position. After several experiments it was found that a charge of dynamite could not be fired with an electric battery, owing to short circuiting of the insulated wire due to the high pressure of the water. A watertight torpedo was then made out of gas-pipe capped at both ends.

Experiments proved that in this confined space 12 ft. of fuse exploded a cap in four minutes and a half, and an equal length of the same fuse tested in the open air exploded a cap in six minutes and a half. The torpedo with which it was intended to blast off the

4-in. pipe in 2,500 ft. of water, was made of a 7-ft. length of 2-in. standard pipe, with 9 in. of 1½-in. pipe on the top end, a suitable size for the recovering tap. The intention was that the torpedo should be stopped by the top of the broken drill-rod, the end of which was 10 ft. from the bottom of the shaft, and the charge consisting of twenty-one sticks of gelatine, would break 17 ft. to 20 ft. of the bent pipe. Two 20-ft. lengths of fuse were used with insulated copper wire between to prevent the coil from burning across and making a short circuit.

RESULT OF SIXTY DAYS' WORK.

When all was ready the torpedo was put in a vice, the ends of the fuse lighted, and the top cap screwed tightly on. The destroyer was then taken to the head of the shaft and dropped in the 5-in. pipe, one minute having elapsed from the time the fuse was lighted until the torpedo was let go. In three minutes and a half the torpedo was heard to strike the top of the 4-in. pipe 2,317 ft. from the surface, the velocity through the 5-in. pipe being about 11 ft. per second. In another minute the torpedo struck the top of the broken drill-rod near the bottom of the shaft, having travelled through the 119 ft., the lower portion of which was lined with boiler tubing having an internal diameter of 3·17 in., at the rate of 3·16 ft. per second. Thirty-six seconds after having reached the broken rod the explosion took place, the time which had elapsed from the time of lighting the fuse to the time of the explosion being six minutes and six seconds. According to the previous experiments with one fuse enclosed in a pipe seven minutes and a half should have elapsed, but it is possible the fuses burnt more rapidly, due to the heat generated by two fuses burning in the same pipe.

The following day the "B" drill-rods were lowered with 20 ft. of 2½-in. pipe, having a 3½-in. chisel bit on the lower end, which revolved within 4 ft. of the bottom of the shaft. It was surmised that the bit was working on iron, and when brought to the surface as there was no bend in the pipe, the indications were that the 4-in. pipe had reached the bottom in practically a vertical position. A recovering-tap was then lowered, and brought up the piece of 1½-in. pipe which had been placed at the top end of the torpedo. A diamond bit, $2\frac{15}{16}$ in. in diameter, was lowered, and, after considerable difficulty, succeeded in making a start through the loose material at the bottom of the shaft, boring a sufficient distance to make a seating for the 2½-in. pipe, which it was intended should serve as a permanent guide for the drill-rods in subsequent drilling. The 2½-in. pipe, which was tapered to 2⅛-in. at the lower end, so as to enter the hole, was then lowered, and, after considerable trouble, was fixed in the hole prepared for it. After this 2½-in. pipe had been properly seated no further difficulty was experienced, and in sixty days 428 ft. of drilling was accomplished, making a total depth of 2,948 ft.

The drill used in this work was a Sullivan "B" machine. The time required for hoisting and lowering the rods, taking out the core and putting on new bits, was four hours and a half. The novelty of this drilling operation was in starting the drilling at the bottom of a shaft 2,525 ft., full of water, with no fixed guide for the drill-rods in the last 95 ft. to the bottom to hold them laterally, and the difficulty of the work was to obtain a seating for the external guide-pipe.

Paper read before the South African Association of Engineers.

THE LABOUR MARKET.

BOARD OF TRADE statistics show that as compared with a year ago, employment in the majority of trades showed some improvement last month, especially in the metal, cotton, and woollen trades. In the building trade and the jute trade there has been some decline.

COAL MINING.

Employment in this industry in July, making due allowance for holidays, showed a slight decline, both as compared with a month and a year ago.

IRON MINING.

Employment was good, and showed little change compared with a month ago and a year ago. At the 117 mines and open works covered by the returns received from employers the average weekly number of days worked during the four weeks ended July 22nd was 5·72, as compared with 5·62 (reduced by 0·24 of a day on account of Whitsuntide holidays) in the previous month, and 5·73 in July, 1904.

PIG IRON INDUSTRY.

Employment in this industry during July showed no change as compared with June, and was considerably better than a year ago. Returns relating to the works of 108 ironmasters showed that 322 furnaces, employing about 23,000 workpeople, were in blast at the end of July—the same number as in June, and 21 more than in July, 1904.

CHANGES IN RATES OF WAGES.

The net effect of all the changes in rates of wages reported in July was an increase in wages of nearly £4,600 per week. The changes affected over 183,300 workpeople, of whom about 137,300 received advances while over 46,000 sustained decreases.

THE PROTECTION OF IRON AND STEEL STRUCTURES.

ABOUT eleven years ago experimental investigation was begun with numerous well-known and established iron paint-preservatives, in order to ascertain by actual exposure tests the best one to resist the destructive action on steel structures of sulphurous gases in the form of smoke combined with the moisture of steam, and since that time fifty or more paints and combinations have been tried.

These included asphaltum, rubber, graphite, carbon, lead and iron paints, and though the results showed varying degrees of resistance, it is remarkable that even with three coats of paint not one was found that did not show rust in less than a year. Of course, it is to be understood that the exposures were made so as to subject the test bars to the severest action possible in order to obtain the quickest results.

In making the first series of tests new steel plates 10 in. square were used. As, however, the adverse conditions we were trying to overcome related to rusty steel, which is more difficult to preserve than new steel, rusty plates were substituted in all tests thereafter. And to still further endeavour to meet the existing conditions new plates were hung up and exposed to the smoke fumes until they became covered with sulphur scale, the thought being that an oxide scale due to atmospheric exposure might give different results. This scale or rust formation on these new plates apparently varied not only in amount, but also in the time of its formation, supposedly due to different chemical composition. As this might again give some variations in the experimental results, in order that all paints should be on as like footing as possible, angle bars 11 ft. long were made use of and as before hung in the smoke until rusted, then cleaned with wire brushes, each foot of the bar being painted with a different paint and again hung up. The results, however, continued to be unsatisfactory.

In examinations of the test bars from time to time it was seen that upon many of them the paint was intact but with protruding points which upon being pricked were found to be small rust formations pushing up the paint from behind, clearly indicating that it was not the failure of the paints but the rust action of the inner surface that caused the damage. As no rust can form without the presence of moisture, and as all the paints are pervious to moisture (as Dr. Dudley's careful investigations of the subject have proved) this led to the conclusion that it would be necessary in some way to tightly seal the surface. Many kinds of materials for doing this were tried, with as many different results, until three years ago it was decided that a cheap paraffin paper answered the purpose best of all and since that time all experimentation has been along that line. The few test bars that have been brought along and exhibited indicate the results. Besides the experimental bars referred to, the paper covering has been tried in a small practical way against smoke action, and after two years and three months exposure an examination of very recent date shows the outer paint, the paper and the first or adhesive coat all intact, and in many places where paper was removed for examination the adhesive coat not yet dry and the surface of steel the same as when painted.

With such satisfactory results from this paper-process in the smoke tests, it was concluded to make a large-scale application and severe test on a large number of I beams supporting a floor over and within a few feet of salt water and upon which the rust was due not to smoke but to the almost continuous dampness and presence of sewer gases. This was done over a year ago and up to the present time no indication of damage is apparent.

The mode of application of the paper is as follows: After the rust is carefully cleaned off by means of stiff wire brushes, a certain kind of tacky paint is applied, the paper then covered over and tightly pressed upon the painted surface, the joints of the paper slightly lapping. As soon as the paper is in place, it is ready for the outside coat of paint. It will be observed that by this process, the first coat of paint, the paper and the coat of paint over the paper can be applied with one scaffolding, thereby greatly reducing the cost, especially in high and dangerous places.

These experiments, extending over only three years, are of too short a duration to determine the value of paper as a protection for iron and steel, but they certainly bring out the fact, at least in the case of smoke and gases, that the action begins from behind the paint and not from in front by the disintegration of the paint.

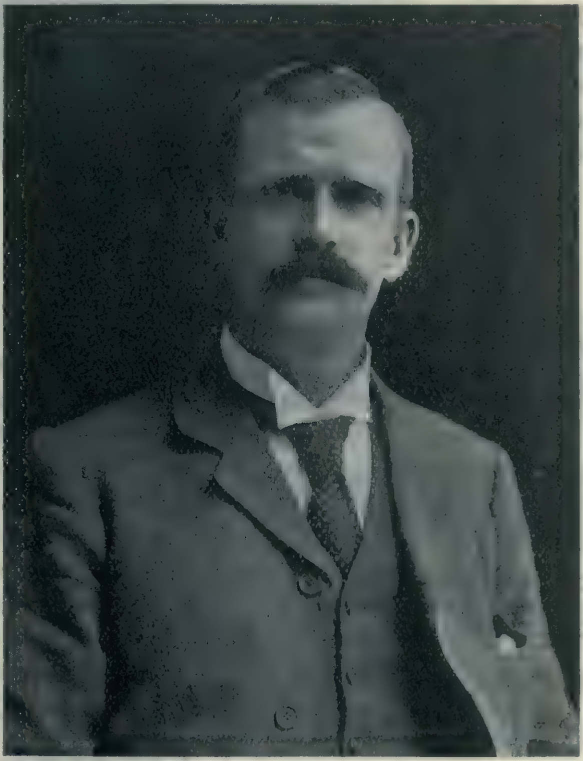
Memorandum presented to American Society for Testing Materials.

OUR WEEKLY BIOGRAPHY.

MR. WILLIAM ARTHUR CALDECOTT, B.A., F.C.S.

MR. WILLIAM ARTHUR CALDECOTT, whose interest in technical education is known throughout the Witwatersrand, was born in Malta on November 17th, 1869, his father being the Rev. W. S. Caldecott, a grandson of one of the 1820 settlers in the Cape Colony. He was educated at the Grahamstown Public School, and subsequently studied science under Dr. Hahn at the South African College, Cape Town.

In 1889 he came to the Transvaal and entered the old Du Preez (now Rietfontein) battery as an amalgamator. About June, 1890 he transferred his services to the Cassel Gold Extraction Company, for whom Mr. J. S. MacArthur was then demonstrating the value of the cyanide process at the old Salisbury battery. After a few months' experience in the operation of the method he went to Barberton, and worked the rich Sheba tailings by this process. After some time on the Rand, on Moodies (De Kaap) and at Pilgrim's Rest, he was called upon to give evidence in 1896 for the African Gold Recovery Company in the well-known cyanide patents case. During the next three years he gained considerable metallurgical experience with the Rand Central Ore Reduction Company. His work at this time was mainly concerned with the treatment of accumulated slimes and the precipitation of gold from cyanide solutions.



WILLIAM ARTHUR CALDECOTT, B.A., F.C.S.

During the war he visited Rhodesia, and afterwards was appointed to the position he now holds as consulting metallurgist to the Consolidated Gold Fields of South Africa, Ltd. At the present time Mr. Caldecott is chiefly engaged in the finer crushing of the blanket ore on the lines indicated in a paper of that title read last year before the Institute of Mining and Metallurgy. He was president of the Chemical Metallurgical and Mining Society of South Africa during 1904-5 and is a member of the Institute of Mining and Metallurgy and various other technical societies in South Africa and elsewhere, to which he has contributed a number of papers on the metallurgy of gold.

HEALD CYLINDER GRINDER.

BUILT BY THE HEALD MACHINE COMPANY, WORCESTER, MASS.

THE machine illustrated herewith is designed for the accurate finishing of gas and gasoline engine cylinders, and internal grinding of parts which it is impracticable to rotate. It consists of a main frame or column carrying a grinding spindle which revolves about a horizontal axis. This grinding spindle is mounted in double eccentrics. Eight different speeds of rotation are given to the eccentrics to handle work of different diameters and conditions. The wheel spindle runs in bronze boxes, provided with a simple adjustment for wear. The end of the wheel spindle is made tapering to receive wheels mounted on collets, thus allowing wheels to be changed without delay in truing up. Provision is also made for feeding out the wheel to regulate the depth of the cut, while the machine is in motion.

On the front of the column is a knee, carrying the main sliding table, which travels back and forth in a line parallel to the grinding spindle. On the top of this table is a cross slide table for giving crosswise adjustment. In the operation of this machine the work does not rotate but is held in position by means of jigs or other fixtures on the table of the machine, which is a

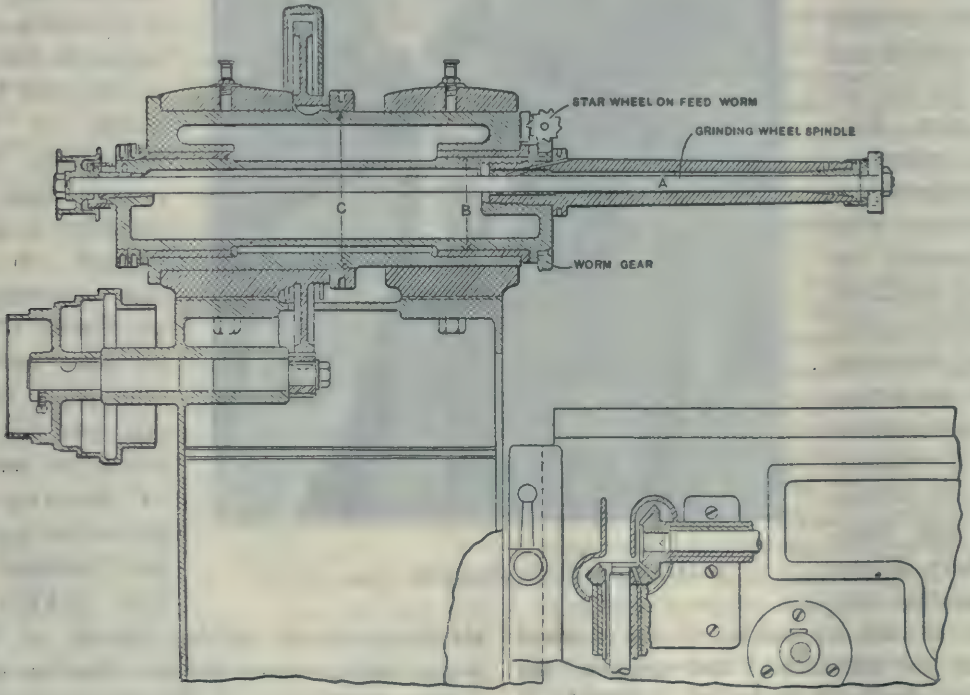


FIG. 1. DETAILS OF THE HEALD CYLINDER GRINDER, SHOWING THE MECHANISM FOR THE PLANETARY MOVEMENT OF THE WHEEL.

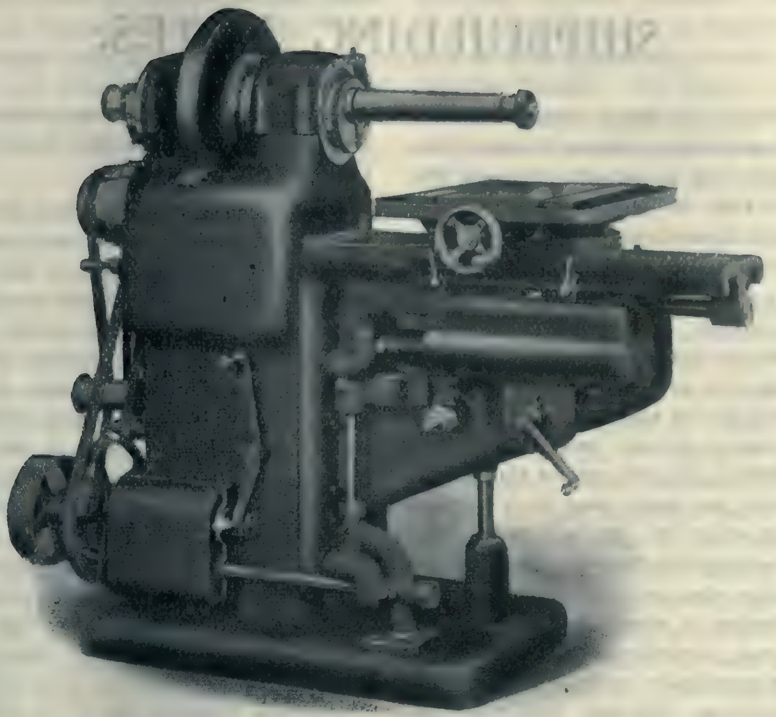


FIG. 2. THE HEALD CYLINDER GRINDER.

convenient method of handling work when it is large or out of balance so that it is not easy to rotate it. This method of handling also makes it possible to grind duplex cylinders as readily as single cylinders, an advantage that will be greatly appreciated. By means of the vertical adjustment of the knee on the column and the crosswise movement of this upper table any adjustment of the work can be obtained, either to bring a single hole in line with the grinding spindle or to transfer the work from one hole to another, as is necessary when duplex cylinders are to be ground. The travel of the table is automatic, reversing accurately at any point desired. The rate of traverse is controlled by a change-gear box on the column of the machine, giving three different rates of feed to the table. A feature of the machine illustrated is the mechanical arrangement for procuring the planetary movement of the wheel. The grinding spindle A, carrying the wheel and running at a high rate of speed, is situated eccentrically in a second spindle B, which in turn is eccentric in a third or outer spindle C. The larger spindle revolves at a low rate of speed, carrying the spindle B with it. Consequently the wheel spindle rotates in an orbit, and the diameter of the hole being ground is always equal to the diameter of this orbit plus the diameter of the grinding wheel. The diameter of the orbit depends upon the relation of the two eccentrics. When the throws of these are opposed to one another the diameter of the orbit is a minimum and the grinding spindle is concentric with the outer spindle. In this condition the wheel would grind as if it were mounted on an ordinary spindle. When the eccentric B is revolved with respect to C the orbit of the grinding spindle becomes larger until the maximum throws of the eccentrics are combined, when the greatest diameter can be ground.

SHIPBUILDING NOTES.

ON Thursday, 17th inst., Messrs. William Gray and Co., Ltd., launched the steel-screw steamer *Drumloist*, which they have built to the order of Messrs. Wm. Christie and Co., Ltd., of London and Ardrossan. She is built to Lloyd's highest class, and of the following dimensions, viz.: Length overall, 346 ft. breadth 50 ft., and depth 23 ft. 5 in., and is specially designed for the owners' railway wood-sleeper trade. The cellular double bottom extends throughout for water ballast, with a large after peak ballast tank, whilst the side tanks have capacity for about 600 tons additional water ballast, giving over 1,600 tons in all. These side tanks (McGlashan's Patent) extend through the main and after holds and engine room for a length of 190 ft., in way of which the ship has double sides, which add to her strength and safety. They are also of special advantage when ore, coal or grain cargoes are carried, presenting a smooth surface which is easily cleaned down, preventing the lodgment of dirt, which occurs in ordinary vessels behind stringers and between the frames. The side ballast also improves the behaviour and speed of vessels running light, and considerably reduces the "racing" of the machinery. The machinery consists of a set of triple-expansion engines and boilers capable of developing over 1,500 h.p., cylinders 24½ in., 40 in., and 35 in. diameter, with a 42-in. piston stroke and large main boilers to work at a pressure of 180 lb. per square inch. It has been constructed at the Central Marine Engine Works of the builders. The ceremony of christening the steamer *Drumloist* was performed by Miss Watson, daughter of Councillor T. W. Watson, Hartlepool.

On the 19th inst. there was launched from the yard of Messrs. William Doxford and Sons, Ltd., Pallion, a specially designed single-deck turret steamer for general measurement trades, having a deadweight capacity of 6,800 tons on 22 ft. draft of water. She is fitted with tri-compound engines by Messrs. Doxford, 24 in., 41 in., 68 in. by 45 in.; two large single-ended boilers of 180 lb., and very special outfit of cargo-discharging gear. When completed she will receive the Bureau Veritas Class, having been built under their special survey for their highest class; also under the survey of Messrs. Havelock and Charton, Newcastle, on behalf of the owners. She has been built to the order of The Hathor Steamship Company, Ltd., London (Messrs. H. B. and A. Gourlay, managers), the chairman of the company being Mr. Henry Gourlay, formerly one of the best known shipbuilders of Dundee The vessel was named the *Hatumet* by Miss Vera Doxford, of Grindon Hall.

On the 17th inst. Messrs. Wm. Pickersgill and Son, Sunderland, launched from their yard at Southwick a steel-screw steamer, built to the order of Messrs. Japp and Kirby, Liverpool, this being the sixth steamer built by this firm for these owners. Her dimensions are: Length, 372 ft.; breadth, 46 ft. 3 in.; and depth, 28 ft. 2 in. She has been built under special survey to take Lloyd's highest class as a spar-deck steamer. The vessel is built on the deep-frame principle, and is fitted with cellular double bottom throughout for water ballast, in addition to which the after and fore peaks are fitted as tanks, and a large deep-chamber tank has also been constructed abaft the engine room with a view to enabling the steamer to go on long voyages in ballast, if necessary, with increased safety. The scantlings have been considerably increased above Lloyd's spar-deck rules to enable her to claim a three-deck freeboard, which will allow of her carrying a large deadweight cargo on a moderate draught. She is also fitted with an extra long bridge, extending over nearly 200 ft. amidships. The vessel is provided with six large cargo hatchways, each of which is fitted with double derricks, capable of raising heavy weights, large derrick posts being fitted where necessary for this purpose, and the ventilation of all cargo-holds has been specially attended to, four large ventilators being fitted to each hold. The vessel will be rigged as a two-masted fore and aft schooner, with steel lower masts, and wood telescopic topmasts, and her eight steam winches will be supplied by Messrs. Clarke Chapman and Co., Ltd., of Gateshead, while a special quick-warping windlass will be fitted by Messrs. Emerson, Walker and Thompson Bros., also of Gateshead, and a steam-steering gear by Messrs. Lynn and Co., Sunderland, is fitted in house amidships abaft the engine room, and controlled by means of rods and bevelled wheels from bridge. The donkey boiler for supplying steam to deck range will be made by Messrs. Riley Bros., Stockton-on-Tees. The machinery and boilers are being supplied and fitted by Messrs. Geo. Clark, Ltd., of Southwick, the engines being of the triple-expansion type, having cylinders 24 in. by 40 in. by 67 in., and a stroke of 45 in., and two large boilers of steel, with a working pressure of 180 lb., fitted with Howden's forced draught. As the vessel left the ways she was named the *Barra*.

A record passage across the Atlantic has been made by the Allan Line turbine steamer *Virginian*. The *Virginian* left Lough Foyle at 4.30 p.m. on Friday, August 4th last, and passed Belle Isle, at 7 p.m. on Tuesday last, having made the run across the Atlantic in 4 days 2½ hours, or, allowing for difference in time, 4 days 6 hours.

The Société Cockerill recognise the advantages of the deep water on the Skelmorlie measured mile. The Dover-Ostend turbine steamer *Princess Elizabeth*—which is by the way the first Parsons' turbine steamer to be built on the Continent—has been sent from Hoboken to the Clyde for her steam trials. It will be remembered that difficulties have been experienced in getting the required speed out of fast boats on the Maplin and shallow courses generally.

The Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, have just launched the s.s. *Queen Amelie*, built to the order of the Dunlop Steamship Company, Ltd. This steamer is the fifth built for the above company, and is 382 ft. long by 48 ft. beam by 30 ft. 8 in. deep, and has been built under special survey to the highest class at Lloyd's, spar deck rule, with extra strengthening for special freeboard. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes is being arranged for. She has been constructed to a fine model with a view to rapid speed and economy in fuel, and the machinery will be supplied by Messrs. The North-Eastern Marine Engineering Company, Ltd., consisting of engines with cylinders 24½ in., 40 in., and 68 in. by 48 in., three large steel boilers 13 ft. 9 in. by 11 ft., 180 lb. working pressure. The steamer will carry about 7,200 tons loaded, and is expected to steam about 10 knots speed.

Messrs. Murdoch and Murray, shipbuilders, Port Glasgow, have launched the second of eight steamers which they have contracted to build for service on the river Amazon. The new steamer is a single screw vessel of the usual type, and will be engined by Messrs. Ross and Duncan, Govan. As she left the ways she was named the Uniao.

The *Princess Elizabeth* is now running in the Dover-Ostend service. The boat, which is 350 ft. long by 40 ft. beam was constructed at Antwerp, and successfully went through her trials on the 9th inst., on the Clyde, showing an average speed of 24 knots on four runs. The hull of the vessel, boilers, and parts of the machinery have been built by the John Cockerill Company; the turbine machinery was constructed at Wallsend under contract with the Parsons Foreign Patents Company, Ltd.; the auxiliary machinery, wet and dry air pumps, circulating, feed, oil, sanitary, and bilge pumps have all been supplied by Messrs. G. and J. Weir, Ltd., of Glasgow. The boilers, eight in number have been fitted with Howden's system of forced draught with fans and motors supplied by that firm. During the trials the machinery and boilers worked most satisfactorily. The manœuvring powers of the vessel were tested severely, and a mean speed of 16 knots per hour was obtained when going astern.

On the 14th inst. the s.s. *Stagpool*, built by Messrs. Ropner and Son, of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of the Pool Shipping Company, Ltd., West Hartlepool (of which company Messrs. R. Ropner and Co. are managers), and is fitted with the builders' patent improved trunk deck. The vessel is 366 ft. in length and has a deadweight carrying capacity of about 7,200 tons. Her outfit is thoroughly up to date, and include stockless anchors, quick warping steam windlass, steam steering gear amidships, and powerful screw gear aft, as well as the most modern appliances for loading and discharging cargoes expeditiously. The engines are of the triple-expansion type, by Messrs. Blair and Co., of Stockton-on-Tees, of about 1,850 i.h.p.

The s.s. *Kaiping*, which has been built to the order of the Chinese Engineering and Mining Company, Ltd., by Swan, Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne, was recently taken to sea for her trial trip. The following are the chief dimensions: Length overall, 322 ft; beam extreme, 44 ft. 3 in., and depth moulded, 23 ft. She has been designed for the owners' special trade on the China coast, and has been built to Lloyd's highest class, spar-deck rule. Accommodation has been provided for first-class passengers amidships, and a large number of Chinese passengers aft. The vessel has been designed to carry a large cargo on a draught of 18 ft. 9 in., and to steam 12½ knots at this draught. The engines have been constructed by the Wallsend Slipway and Engineering Company, Ltd., Wallsend-on-Tyne, and consist of a set of triple-expansion engines, having cylinders 25½ in., 41½ in. and 68 in. by 45 in. stroke, steam being supplied by two large single-ended boilers working at 180 lb. pressure, and fitted with Howden's forced draught. On the trial trip the machinery worked satisfactorily, and a mean speed of 13 knots was attained on the measured mile, the vessel being fully loaded.

On Saturday, the 19th inst., there was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders. Selby, a steel screw tug, the principal dimensions being

94 ft. b.p., by 19 ft. 6 in. by 11 ft. 6 in. depth moulded. The vessel has been built to the order of Mr. Wm. Watkins, of London, and will be fitted with powerful engines by Mr. George T. Grey, of Holborn Engine Works, South Shields. She is fitted with steam winch windlass by Messrs. Clarke, Chapman and Co., combined steam and hand steering by Messrs. Davis and Co., and is replete with all the latest improvements for this class of tug. As the vessel left the ways she was christened the *Liberia* by Miss Cochrane, of Hull.

On Thursday, the 17th inst., there was launched from the shipyard of Messrs. Cochrane and Sons, Selby, the steel-screw tug *Java*, the principal dimensions being 94 ft. b.p. by 19 ft. 6 in. by 11 ft. 6 in. depth moulded. The vessel has been built to the order of Wm. Watkins, Esq., of London, and will be fitted with powerful engines by Mr. George T. Grey, of Holborn Engine Works, South Shields.

Messrs. William Symons and Co., Ltd., Renfrew, recently launched, with all machinery on board, and with steam up ready for work, a large and very powerful bucket hopper dredger constructed to the order of the Port Trustees, Karachi, for the improvement of Karachi harbour. The new dredger, which is a sister ship to the *William Price*, constructed over seven years ago by the same builders for the Karachi Port Trust, has a hopper capacity for 1,250 tons of dredgings, and has been built to Lloyd's highest class for a vessel of this type. The bucket ladder, constructed upon the most improved form of girder work, is designed for dredging to a depth of 45 ft. below water level. The normal bucket dredging capacity is 1,200 tons per hour. The vessel is propelled by two sets of triple-expansion surface condensing engines of most modern design, sufficient power to obtain a speed of 10 knots per hour. Either sets of engines can be employed for dredging and change-gear is provided so that the full power of the engines can be exerted whether the vessel is working on hard or soft ground. Steam is supplied from two large multitubular boilers, constructed to Lloyd's rules for a working pressure of 160 lb. per square inch. Independent steam winches, one provided at bow and one at stern, for manœuvring the vessel when at work, and independent steam hoisting gear is fitted for controlling the bucket ladder. The hopper doors and side shoots are also manipulated by independent engines. The dredger has been constructed under the direction of Mr. Edward Jackson, M.Inst.C.E., engineer to the Karachi Port Trust and Mr. D. Morris, M.Inst., C.E., Ammanford, South Wales, the Trustees' Home representative, assisted by Mr. E. G. Carey, Uddington, resident inspector. As the dredger left the ways the christening ceremony was performed by Mrs. Jackson, wife of the engineer to the Port Trustees.

On Tuesday afternoon, the 15th inst., Messrs. Ropner and Son launched from their yard at Stockton-on-Tees a steel screw steamer of the following dimensions: Length, 350 ft.; breadth, 46 ft.; depth, 26 ft. 1 in. The vessel will be classed 100 A 1 at Lloyd's, and is built on the three-deck rule, having one deck laid, full poop, long bridge, and top-gallant forecastle. The accommodation for captain, officers, and engineers will be fitted up in houses on bridge, and the crew will be berthed in the forecastle as usual. The engines will be of the triple-expansion type by Messrs, Blair and Co., Ltd., Stockton-on-Tees, of about 1,350 h.p., having two steel boilers, 16 ft. by 10 ft. 6 in., with a working pressure of 180 lb., and fitted with evaporator spare tail-end shaft, etc. The vessel has been built to the order of Messrs. Gladstone and Co., West Hartlepool, under the superintendence of Mr. Chas. Brokett.

Messrs. Scott, Ltd., of Kinghorn, launched recently a steel screw steamer for the Australian coasting trade for carrying log timber. Her dimensions are 130 ft. by 23 ft. by 9 ft. 8 in., and she is constructed on the usual floor principle, with long raised quarter-deck, high casing amidships, and top-gallant forecastle forward. The vessel is fitted with powerful steam winches and derricks for the efficient handling of heavy logs. Her engines are 14 in. and 29 in. by 21 in. stroke, with steam supplied from a large main boiler at 130 lb. working pressure. The vessel has been built to the order of Mr. George Wallace Nicoll, of Sydney, and has been supervised, on behalf of her owner, during construction, by Messrs. John Reid and Co., Glasgow. The steamer, which is named *Duranbah*, is built to the classification of the Bureau Veritas Registry.

On Wednesday, the 16th inst., Messrs. Craig, Taylor and Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, the *Claverhill*, a handsomely modelled spar-deck screw steamer, of the following dimensions, viz.: 369 ft. by 49 ft. by 28 ft. 9 in. depth moulded. Her engines have been constructed by Messrs. The North Eastern Marine Engineering Company, Ltd., Sunderland, the cylinders being 26 in. 42 in., 72 in. by 48 in., with three large steel boilers to work at 180 lb. pressure. She has been built to the order of Messrs. Edmund Haslehust and Co., of London, under the superintendence of Messrs. Jacobs and Barringer, of London. Commander F. W. Parker, R.N.R., being the resident inspector.

IRON ORE DEPOSITS ABROAD.

POSSIBLE FIELDS FOR FUTURE ENTERPRISE.

(*Continued from page* 353.)

ALGERIA—BÔNE.

IMPORTANT deposits of iron ore have recently been discovered at L'ouenza, between Morssot and Aïn-Juetar, Djebel-Boukadra, at the south of L'ouenza. The nearest port is Bône. L'ouenza is situated 100 miles from Bône, and Djebel-Boukadra 115 miles from that place. No railway or good roads exist between these places and Bône. Should a railway be made the transport might cost about 4 centimes per ton mile.

The Mokta mines, situated at twenty-five miles from Bône, have been worked during forty-five years. About thirty million tons have been shipped to Holland, France, and the United States.

GERMAN EAST AFRICA.

Mr. Sinclair, Zanzibar, reports that besides many small lodes which are not of sufficient importance to be taken into account as far as European interests are concerned, there are three localities which, owing to favourable conditions for transport, etc., might be exploited with satisfactory results. So far no European trade in iron ore has been carried on.

The first of these iron fields is at Uluguru, near Hudussi (Mount Ludsanda), in Upper Mgeta; here the soil is heavily ferruginous, and there are large blocks of iron stone, and in Upper Mbakana, in the Uluguru Mountains, a lode of rich iron ore exceeding half a metre in thickness has been observed and traced for upwards of a hundred metres.

The chemical analysis of the Hundisi iron is as follows—

FeO_2 1·85, Fe_3O_4 65·52, M_2O_3 ·16, CaO ·17, MgO ·69: residue 30·88—total 99·27.

The analysis of ore from the Mbakana-District is as follows—

TiO_2 25·31, $Fe_2\ O_3$ 63·49, M_2O_3 0·22, CaO 0·38, MgO 2·15: residue 7·43—total 98·98.

From the above it will be observed that the first sample alone would be useful for smelting purposes; the high percentage of titanium in the latter rendering is unsuitable.

The port nearest these iron fields is Dar-es-Salaam, some 150 miles distant, and the transport to the coast would have to be made by porters at a cost of about 227 rupees per ton. When a railway is built connecting Uluguru with the coast the transit will, of course, be naturally reduced.

The two other iron fields are in the Kinga or Livingstone Mountains, not far from Lake Nyassa. At Mount Liganga there is a bed of iron ore some ten metres in depth, and extending over four miles. At Lipura there is a bifurcated lode several hundred metres in length averaging some fifteen metres in depth. Here, too, are large quantities of ore on the surface in the form of huge blocks.

The ore from these localities would appear to be clean and of good quality, but analyses have not yet been prepared. The Liganga Mountain may possibly be capable of being exploited with profit, owing to the small cost of working, as thousands of blocks of ore are lying on the surface. The transport, however, presents a difficulty, as Lake Nyassa is four days' journey distant, and the intervening country is rough and difficult.

At Lipura there are also rich blocks of ironstone and the question of transit is not so difficult. Lake Nyassa is only one day's journey distant, and the nature of the country is such that a trolley railway could be run with comparative ease.

TUNIS.

Mr. Consul General Berkeley reports on two deposits: Deposit A.—Rich iron ore, of which there is several millions of tons in sight 140 miles south-west of Tunis port. Deposit B.—On the north coast of Tunisia, between Bizerta and Tabarka. Tabarca is nearer, but the port is not yet constructed for receiving large steamers. Bizerta is 60 miles from the ore deposit. No railway tariff on iron ore exists yet.

A railway is in course of contruction by the Government, which runs through deposit A, and will be completed in about two years. The rate would probably not exceed 5 francs per ton.

Deposit B.—Transport would not be possible except by construction of a railway; none exists yet. Native and European labour is obtainable at prices ranging from 1 franc and 50 centimes to 4 francs per day.

Deposit A.—Cost of quarrying and placing on truck would not exceed probably 2 francs and 50 centimes per ton.

Deposit B.—Government engineer estimates cost of working 2 francs and 50 centimes per ton, and value of same 9 francs per ton f.o.b. Bizerta, thus leaving a margin of 6 francs and 50 centimes for cost of carriage (by a railway, which may eventually be constructed) and for profit.

Deposit A.—Owners give analysis as—Iron 60 per cent., manganese 2 per cent., silica low percentage, and free of sulphur, phosphorus and arsenic.

Deposit B.—Quality rather inferior. The official samples give an average—Iron, 50 per cent; silica, 13·5 per cent; phosphorus, 0·027 per cent.; manganese, 0·480 per cent.; lime, 0·700 per cent.; sulphur, 0·460 per cent.; and arsenic, 0·066 per cent.

Deposit A.—The owners are zinc and lead mine proprietors, in whose concession occurs the iron deposit in question. They are disposed to sell rather than work it themselves, but would probably ask a full price.

Deposit B.—The owners are a strong company but await a solution of the railway question. They would be willing to enter into any reasonable scheme for the sale of all their output of ore to a firm willing to assist them in the construction of a private line to Bizerta, thus dispensing with Government intervention.

As regards the more interesting deposit designated as "A": The value of the ore can be easily determined; also its cost of working and placing on trucks. A railway tariff would no doubt be arranged which would be amply covered by the margin resulting from the two first calculations. As stated above, the line in course of construction runs through this property, and the Government would be inclined to foster by a favourable tariff, an industry which would be such a valuable source of revenue to them.

MADAGASCAR - ANTANANARIVO.

Mr. Consul Porter reports that deposits of iron ore of excellent quality exist throughout the greater portion of the central provinces of Madagascar.

Of these the best known is situated about thirty miles east of Antananarivo, on the western border of the forest belt. The nearest shipping port capable of admitting ocean steamers is that of Tamatave, distant 200 miles. Transport to Tamatave is by road, the rate being £5 per ton. Native labour is obtainable at an average wage of 1s. per day. No estimate of the cost of mining can be given, as the deposits have never been properly worked. No official analyses of ore from Madagascar appear to have been made.

All mines and mineral deposits in this colony are the property of the Government. Permission to work minerals is granted to Europeans in accordance with the terms of the Mining Law of the 20th July, 1897. Only one or two such permits have been applied for. The total output is insignificant. owing to transport difficulties.

KÖLN - MÜSENER SMELTING PROCESS.

NOT a little attention is being paid in German engineering circles to a smelting process which has been patented by the Köln-Müsener Mining Company in Kreuzthal. The process, which is described in the current number of the Scientific American, is intended to be used mainly in the operation of blast furnaces, its object being to open with extraordinary rapidity any closed blasting moulds or obstructed tapping holes. It further serves to dismount rapidly any kind of iron construction.

The risk and heavy loss involved in blast-furnace operation whenever the tapping hole does not open normally, and the hard and oftentimes useless work of many hours in chiselling through the hardened mass with steel rods, are known to every metallurgist. There is the risk of the rising liquid pig iron reaching the water-cooled cinder moulds and the tuyeres which may result in fatal explosions and bursting, These difficulties and risks are claimed to be done away with by the Köln-Müsener process, which is carried out in a few minutes.

The process consists in heating the mass to be melted in one of its points by any means, to the combustion temperature of its combustible components, after which oxygen is thrown against it under high pressure. The local combustion heat in the concentrated oxygen current is so enormously high that the neighbouring parts will at once become liquefied.

To preheat the material an oxy-hydrogen flame is used to advantage in most cases, while electrical arcs, for instance, can also be used for this purpose. In the latter case it will be possible to pierce cold armour plates of 200 millimetres (8 in.) diameter in about ten seconds. The current from two accumulator cells that furnish 120 amperes at 2·3 volts will be quite sufficient. The fact that this process renders it possible to remove the iron before the copper from assembled iron and copper plates without any prejudice to the copper, will be found interesting and important for many purposes. This will prove of importance also for blast-furnace operation, it being possible to melt into the extensions of copper or bronze blasting moulds or cinder moulds without any risk to the copper.

The process may prove valuable whenever dismounting work is to be performed at short notice, the operation being reduced to a few minutes' work, while the cost as compared to the efficiency is quite negligible. It is true that the construction of special types of apparatus is required to enable the process to be safely carried out.

A COLLECTING AND COMPRESSING MACHINE FOR CO_2.

By R. Mackenzie.

THE following paper describes a method of compressing carbonic acid gas (CO_2), and the apparatus used for the purpose. The gas is drawn from the vats in which it is generated by a fan driven by an electric motor, and is passed through a cylinder or tower 25 ft. high filled with coke. The gas enters at the bottom of the tower and passes through the coke, where it is met by a spray of water, which passes into the tower at the top. After undergoing partial purification by the spray the gas continues its progress into an ordinary gasholder. This gasholder is used merely for the sake of convenience, as the gas could be drawn direct from the vats to the machine. It is then drawn from the holder by the pump forming the first stage of compression. This pump or compressor is fitted with suction and delivery valves on the top and bottom end of cylinder, and the gas is compressed to a pressure of 20 lb. per square inch on a piston 10 in. in diameter by 18 in. stroke.

The gas is discharged from this cylinder into the purifiers, consisting of six horizontal outer tubes or shells, into each of which is fitted an internal tube the full length of the shell. This internal tube is fitted just clear of the outer shell, and has two rows of perforations along the bottom. The gas entering at the bottom outer tube is forced through these perforations against a head of 6 in. of alkali and other purifying reagents—that is to say, the solution is standing up to the centre of the outer shell, and the gas is compelled to bubble through it. After the gas has passed through, it is then forced through the solution in the next shell, the outer shell of the one member being connected to the inner tube of the next by an internal branch. In this way the gas is forced through the solution in each shell until it reaches the top one.

At this point the solution is forced into the shells by a force pump connected on to the crank shaft of the compressor. When each shell is filled up to its centre with solution it overflows automatically through cascade connections into each succeeding shell until it reaches the bottom one. This latter, when full, overflows into a trap fitted with a ball-cock so arranged that when it contains solution up to the centre it automatically opens and allows the purifying reagent to escape to the drain, and thus keep a continuous flow of solution through the purifiers. Since the flow of gas is upwards and the flow of solution downwards, any escape of gas along with the reagent is prevented.

To return again to the gas, we reached the top purifier after passing the top member of the purifier. Thereafter it continues its course through a tube or shell called the drier, which is filled with chloride of calcium and a layer of cotton wool for the purpose of absorbing any moisture that the gas may have carried with it from the purifiers. From the drier it is sucked by the pump forming the second stage of compression. This compressor is single-acting, with the suction and delivery valve on top, with an ordinary ram piston, the gas being retained in the cylinder by a cup leather. The compression at the second stage amounts to 150 lb. to the square inch on a piston of 10 in. in diameter by 18 in. stroke. The gas is discharged from this stage into a condenser fitted with a spiral coiled tube. The gas enters this coil at the top and is forced out at the bottom, where a connecting pipe leads it to the suction pipe of the third stage of compression, at which we have now arrived. The suction, as I said, was the delivery from the second stage. This compressor is similar to the second stage—that is, a ram plunger with a suction and delivery valve on top, with a cup leather. In this third or final stage the compression reaches 1,000 lb. per square inch on a piston 3½ in. in diameter by 18 in. stroke. The gas is discharged into two spiral coiled tubes immersed in the same condenser as the second stage coil. The delivery pipe between the compressor and the condenser is a single tube, but to give a greater cooling surface it is divided in a coil box into the two spiral tubes already described, the gas entering at the top and leaving the coils again at the bottom (through a coil box similar to the top) into a single tube which is connected to a receiver. The receiver is hung on a spring balance, which indicates at all times the exact weight of gas in the machine, either whilst at work or stationary. From the receiver the gas passes along to the filling main, which is a tube with six valves attached. Each valve is fitted with two separate spindles, the object being to have the valve which blows to the atmosphere closed when the other valve is opened during the process of filling the portable gas cylinders. Then again, by closing the valve which was open from the machine to the portable cylinder and opening the other valve, it allows air to escape from the cylinder. It further allows the blowing away of gas from the cylinder, so as to bring the gas in the cylinder to the same temperature as the gas in the receiver.

During the process of filling each cylinder is standing on a weighing machine, being connected by copper pipes to the filling main. Thus with the six valves six portable cylinders may be charged at the same time. Each cylinder is charged with 28 lb. of liquid carbonic acid, which is equal to about 228 cubic feet of gas at normal pressure and temperature.

It should be mentioned that this CO_2 is obtained as a by-product, and is collected in a very pure state, and, unlike that produced by burning coke, etc., contains very little air—usually the greatest trouble manufacturers of CO_2 have to contend with. This enables us to bottle a very pure and dry gas. The capacity of each portable cylinder is ·55 cubic feet and the water capacity 37 lb. The gas liquefies at 0 deg. C. and a pressure of 540 lb. per square inch.

In conclusion, I may say that the portable cylinders used for conveying CO_2 are, as a rule tested to about 3,750 lb. The greatest care ought to be exercised in the handling and use of CO_2. Frequently I have seen engineers applying hot or boiling water to a CO_2 cylinder to force the gas out quickly. This expedient cannot be too severely condemned. It is extremely dangerous (for one bucketful of boiling water will increase by 600 or 700 lb. per square inch the pressure in a cylinder containing 28 lb. of gas) unless a safety valve is fitted to the cylinder to allow any excess pressure to escape. I may mention that my firm have recently put a patent safety valve on the market, which works automatically. It is fitted with a spring relief, and immediately the excess pressure is relieved the valve closes, thus avoiding the total loss of the contents of the cylinder.

Just recently the CO_2 trade has been considerably agitated by the discussion in the press regarding the consignments of light-weight cylinders containing liquefied carbonic acid, which have been shipped into this country from Germany and are being sold to various consumers in London and elsewhere. These cylinders entirely fail to comply with the Board of Trade regulations.

Comparison between actual tests and measurements of German CO2 cylinders and conditions prescribed by the Home Office Committee of 1896:—

Conditions.	German Cylinders.	Committee's Recommendations.
Thickness of walls	·174 in.	·251 in.
Working stress in metal	11·9 tons per sq. in.	8 tons per sq. in.
Ultimate tensile strength in metal	46·5 tons per sq. in.	28 to 33 tons per sq. in.
Carbon in metal...	·488 per cent. ...	Not more than 25 per cent.
Iron in metal ...	98·226 per cent. ...	Not less than 99 per cent.
Charge of CO_2 ...	$\frac{4}{5}$ lb. CO_2 per lb. of water	$\frac{3}{4}$ lb. CO_2 per lb. of water.

With regard to the last item in above table, it is important to note that although the German cylinder gives a much higher working stress in the metal when internal cylinder pressures are equal, the cylinder actually contains more gas.

Minimum weight which CO2 cylinders of various sizes should fulfil if made in accordance with British Government specifications: —

Maximum weight of CO_2 which cylinders should contain.	Minimum weight of cylinder charged CO_2 without valve caps.	Minimum weight of cylinder empty without valve caps.
22 lb.	82 lb.	60 lb.
24 lb.	88 lb.	64 lb.
28 lb.	98 lb.	70 lb.
45 lb.	175 lb.	130 lb.

Read before the Institute of Marine Engineers.

SAFETY IN MINING SHAFTS.

TRANSVAAL GOVERNMENT COMMISSION.

WE have received from the office of the Government Mining Engineer, Johannesburg, comprehensive details of the work to be undertaken by the Government Commission, which is inquiring into the subject of the safety of persons lowered or raised in shafts. A general invitation is given to tender evidence (oral or written) and inventors will find here an opportunity of submitting safety devices for practical consideration. The Commission will enquire into and report on: (A) The present practice in the matter of conveying persons in mine shafts, more especially with reference to: 1. Winding ropes; (*a*) structure; (*b*) material; (*c*) preservation; (*d*) examination; (*e*) the best method of testing the same; (*f*) the best method of attaching the ropes to the load. 2. The reliability and adaptability of safety catches and appliances in shafts. (B) Further, they will report on and make recommendations with regard to such practice, and the efficiency of the safety catches brought under the notice of the Commission.

CONSTITUTION OF THE COMMISSION.

The following gentlemen have been appointed to serve on the Commission: Messrs. U. P. Swinburne (Acting Government Mining Engineer, Transvaal, Chairman); J. A. Vaughan (Chief Inspector of Machinery, Transvaal); J. S. Fisher (Inspector of Mines, Johannesburg); F. Drake and E. Hopper (Consulting Engineers, representing Transvaal Chamber of Mines); R. M. Catlin (Consulting Engineer, Consolidated Gold Fields of South Africa, Ltd.); H. C. Behr (Consulting Mechanical Engineer, Consolidated Gold Fields of South Africa, Ltd.); S. C. Thomson (Consulting Engineer, Messrs. Neumann and Co.); J. F. Cook (Consulting Mechanical Engineer, Messrs.

Neumann and Co.); G. C. Fox (Consulting Mechanical Engineer, Messrs. A. Gerz and Co.); K. Schweder (Assistant Consulting Mechanical Engineer, Messrs. A. Goerz and Co.); E. Farrar (Consulting Mechanical Engineer, General Mining and Finance Corporation); J. H. Johns (Consulting Engineer, Johannesburg Consolidated Investment Company); D. Gilmour (Consulting Mechanical Engineer, Johannesburg Consolidated Investment Company); C. J. Price (General Manager, Central Administration, Rand Mines, Ltd); A. M. Robeson (Consulting Mechanical Engineer, Messrs. H. Eckstein and Co.); F. Hellmann (Consulting Engineer, East Rand Proprietary Mines, Ltd.); W. L. Honnold (Consulting Engineer, Consoldiated Mines Selection Company, Ltd.); W. Bradford (Manager, Langlaagte Deep, Ltd.); H. R. Skinner (Manager, Durban Roodepoort G. M. Company, Ltd.); J. W. H. Stubbs (General Manager, Randfontein Estates); E. J. Way (General Manager, Kleinfontein Group of Mines); J. A. Hebbard (Manager, Langlaate Estate and G. M. Company, Ltd). Secretary, Mr. J. R. Mackinlay, Mines Department, Johannesburg. Sectional Committees have been formed to consider more particularly the following sub-divisions: (1) Winding ropes, structure and material; (2) Winding ropes, preservation and examination; (3) winding ropes, the best method of testing the same; (4) the best method of attaching the rope to the load. The reliability and adaptability of safety catches and appliances in shafts.

EVIDENCE INVITED.

The Commission, as above indicated, invites the attendance of all persons who are willing to give evidence who are acquainted with the matters of reference set forth in the Schedule. It is requested that any intending witness will communicate with the Secretary of the Commission, address, P. O. Box 1,132, Johannesburg, or Room 74, Winchester House, Johannesburg, as to his willingness to appear and give evidence; his address whither notifications may be sent, and a short statement as to the evidence he is willing to give, specifying those points he considers of particular importance.

SAFETY APPLIANCES TO BE TESTED.

The Commission also invites statements from persons conversant with mining matters, who are unable to attend personally to tender evidence. Such statements may refer to any one, or all of the sections of the inquiry, and should be forwarded to the secretary, supported by affidavit, and type-written if possible. With reference to Section IV., and in order to assist the inquiry into the reliability and adaptability of safety appliances, inventors and manufacturers of safety appliances for use in connection with the raising and lowering of persons in mine shafts are invited to forward to the secretary drawings and plans of their schemes, together with full descriptions of their working. All drawings should be on tracing cloth and suitable for sun print reproduction, of scale one inch to the foot for general views, and three inches to the foot for special details. Models may also be forwarded, but these are not obligatory. Drawings and models will not be returned, but will remain the property of the Transvaal Government. Practical tests under normal working conditions are to be made of appliances selected, and for this purpose it will be necessary for each inventor or manufacturer, when submitting drawings, to also furnish written permission empowering the Commission, if they so desire, to construct or cause to be constructed the appliance in question for purpose of the test. The modifications, if such be necessary, or if such be possible, to enable safety catches or grips to be used in shafts fitted with either wooden or steel guides should be specified. All communications, statements, drawings and models must be dispatched so as to reach the secretary not later than January 31st, 1906.

DETERMINATION OF THE SPECIFIC ELECTRICAL RESISTANCE OF COAL, ORE, ETC.

LAST summer it appeared to the Council of the North of England Institute of Mining and Mechanical Engineers that it was very desirable to have an accurate knowledge of the electrical resistance of coal as well as the rocks above and below any given seam of coal. No data being available, Mr. G. C. Wood, Durham County Council Scholar of the Armstrong College, was asked to undertake an investigation of the specific electrical resistance of coal, ores, etc., and suitable samples were obtained for experiment. The experiments have been carefully carried out by Mr. Wood, and the results obtained, which are of considerable practical interest, have just been laid before the Institute.

The specific electrical resistance of coal, for the cases examined, is, in comparison with the layers above and below the coal, exceedingly high, in fact, so high that coal may be regarded as a very fair insulator. This fact among others is one worthy of note in connection with electrical work underground. When the coal is damp the conductivity is practically wholly due to the water present.

Mr. Wood has recently been determining the specific resistance of a carboniferous limestone from the Barton quarries near Darlington. This limestone has been found very suitable for use as ballast on electric railways employing a live rail.

Prof. H. Stroud, M.A., D.Sc., who wrote the introduction to the report, says he understands that the substitution of this limestone for the coke-breeze at first used on the electric line of the North-Eastern Railway Company, has practically prevented any danger to persons coming into accidental contact with the live rail, provided that there is not a simultaneous contact with the earthed running rail.

In order to obtain the electrical resistance of the coal, ores, etc., the specimens used for this investigation were worked into shapes with parallel faces. A paste of black-lead and water was spread evenly on the faces and dried. A copper-plate was cleaned; on this was laid a sheet of tinfoil, and on this again was placed the sample with one of its blackened faces on the foil. On the top of the specimen was placed another sheet of tin-foil, and then another copper-plate. Thus contact could be established at the two copper-plates, and such a weight was laid on the top as from experiment showed that good contact was made.

The method employed in the measurement of the samples was one or other of the following: (*a*) Wheatstone bridge; (*b*) high-resistance substitution; and (*c*) the high-resistance leakage. The specimens of coal examined were supplied from the Cowpen, Harton and South Hetton collieries. The ironstone was supplied from Skelton Park mines. The lead ore examined was supplied from the Greenside mines, near Penrith.

Lead-ore is shown to be the only ore which, by practical tests based on differences in electrical resistance of large masses could, with certainty, be distinguished from its surrounding rocks.

The following values in megohms per cubic centimetre indicate the magnitude of the specific resistance of coal and other well-known bodies: Gutta-percha, 400,000,000; arc-light carbon, 4,000; and coal, say, 40,000. Coal has, consequently, ten million million times greater resistance than arc-light carbon and ten thousand times less resistance than gutta-percha of the same dimensions.

The following table annexed to the report gives the specific resistances of minerals found in mines:—

Name of Mine.	Description of Mineral.	Specific Resistances per Cubic Centimetre.
		Ohms.
Cowpen	Roof: black shale	445,600
Do.	Coal	36,000,000,000
Do.	Thill: grey sandstone	20,300
Harton	Roof: black shale	337,500
Do.	Steam coal: top panel... ...	80,100,000,000
Do.	Do. bottom panel ..	*
Do.	Gas coal	33,000,000,000
Do.	Coarse coal	3,395,000,000
Do.	Thill: bluish-grey posty shale	105,900
South Hetton ...	Roof: soft blue shale	432,900
Do.	Coal	33,900,000,000
Do.	Thill: blue shale	13,000
	Roof: dogger rock	52,100
Do. ...	Ironstone	167,000
Do.	Thill: bottom rock	52,060
Greenside	Lead-ore	7½
Do.	Old red sandstone	8,280,000
Do.	Mountain Limestone	2,900,000

* This value is omitted from the Table, as the specimen contained iron-pyrites.

THE MINING INSTITUTE OF SCOTLAND.

GENERAL MEETING AT EDINBURGH.

COAL MINING IN CAPE COLONY.

A GENERAL meeting of the Mining Institute of Scotland was held on Saturday, 19th inst., in Dowell's Rooms, Edinburgh, Dr. R. T. Moore, presiding. The paper contributed by Mr. Archibald Russell on "Coal Mining in Cape Colony" created a considerable amount of interest. The gist of the author's contentions was, that although the deposits hitherto discovered were detached, and no great area of country has coal bearing in one region, yet they were, taken altogether, of considerable area, and contained an enormous quantity of coal in seams of workable thickness and quality. This development he maintained had played no small part in the opening up of the resources of South Africa during the last quarter of a century, and the position Johannesburg occupied as the premier gold-producing area in the world was to a great extent due to the existence of immense coal resources in the neighbourhood. He pointed out that although at present there was no prospect of the coal industry of Cape Colony attaining to anything like the proportions of that of Natal or of the Transvaal, yet it would always be a great asset to that colony, considering the mileage of railway lines in the Eastern provinces.

The President observed that one was struck with the large area of coal which seemed to exist in Cape Colony. The seams, however, did not appear to be thick and seemed to be split up with bands of dirt. In addition the coal contained a quantity of ash.

Further discussion on the paper was adjourned until a subsequent meeting.

THE LIEGE EXHIBITION CRITICISED.

Mr. J. Balfour Sneddon, Mid-Calder, followed with a paper describing a few of the more important exhibits in the mining section of the Liege Exhibition. He also gave details of the Belgian collieries visited during Congress week.

The President remarked that what struck one most was the enormous outlay there appeared to be at these Belgian collieries and the comparatively small output. The seams also appeared to be very thin.

In the discussion which followed a few features, described in general criticism as objectionable and antiquated, were touched upon in connection with the exhibition.

Mr. J. T. Forgie, Bathwell, said that so far as it was finished the exhibition was a good one. At the same time he had to confess that he had seen little that was new, and in connection with the collieries visited in Belgium he had observed nothing to adopt and a great deal to avoid. When the members of the Institution were at Liege the exhibition had been open for six weeks, yet even after that lapse of time it was not possible to get a programme, and in addition the machinery and mining sections were in a most incomplete state.

The paper itself gave rise to an animated discussion in which British and Belgian methods were compared greatly to the advantage of the former. The Institute thereafter adjourned.

THE MANUFACTURE AND CHARACTERISTICS OF WROUGHT IRON.

BY JAMES P. ROE.

CORT was the first to avoid contamination of the product through contact with the fuel, thus increasing the available fuel supply, and permitting a limitless variety of forms for the furnace. In conjunction with Hall's improvements, his process was the first, and still remains the only one, which can furnish a good product from pig irons relatively high in silicon, phosphorus and sulphur. Other processes can only take care of one, or at the most two, of the metalloids named. The vastly increased supply of iron ore thus made available had much to do with the supremacy in the iron manufacture so long held by Great Britain, while it promoted also the industrial progress of other nations.

The circumstance that pig irons high in phosphorus and sulphur may be used in puddling has more than an immediate commercial significance. In view of the immense and ever-increasing consumption of iron, there must be a limit to the purer ores and fuels available; and a process in which not only phosphorus and sulphur can be eliminated to any desired extent, but the finished product of which may, if wished, retain four times as much phosphorus as good steel, and yet be a thoroughly reliable material for use, is certain to play a part in the fate of nations.

The puddling process of to-day consists in the use of relatively infusible oxide of iron for the bottom and side fettling of the hearth. Its results are smaller loss of metal, greater output of more certain character, the possibility of using gray pig, and the furnishing of the "physic" that had so long been sought.

The advances in puddling thus sketched have, however, been disappointing, and not at all in keeping with the progress achieved in blast-furnace practice and steel making. This may be explained in part by the vast technical knowledge applied in recent years to the latter lines, leaving the puddling mills largely to the "practical" men, who have worked their way from puddlers to foremen, and possibly to superintendents, without becoming emancipated from the traditions to which they were born.

REACTIONS OF THE PUDDLING PROCESS.

As already remarked, the puddling process permits the use of irons of greatly varying composition. My experience covers irons containing as much as 3 per cent. of silicon and of phosphorus, 2·5 per cent. of manganese, and 0·35 per cent. of sulphur, though, of course, not all in the same pig iron. In all these cases, iron was produced that would weld freely, and showed no cold or red-short tendency. It is not my intention to convey the impresssion that such extreme irons are desirable. On the contrary, they are costly in time, labour, and iron-loss. For rapid work, good yield, and fitness for ordinary uses, a desirable composition would be about 1 per cent. of silicon, a somewhat smaller percentage of phosphorus, 0·1 per cent. of sulphur, and 0·5 per cent. of manganese. For special grades it is necessary to select the pig in each particular case.

The various iron oxides, charged as fettling, flux and oxidising agents, should be characterised, in the order named, by infusibility, fusibility, and the ability to be readily reduced for the part they respectively play in the operation. The flux, as the material directly forming the cinder, must be present in sufficient quantity to receive the oxidised metalloids, and low enough in silicon to retain them as the temperature of the bath increases. This cinder is the vehicle for oxygen, whether supplied by roll-scale, ore, or the oxidising gases of the furnace; it protects the puddled mass from undue oxidation by the gases; and, finally, it forms the welding cinder Its composition is changed during the process by additions; by reactions upon the fettling and the bottom; and by the condition of the fire and position of the damper.

The control of the volume of cinder, in the various stages of puddling, up to the finished product, may be mentioned here.

Throughout all these stages, it is primarily controlled by its composition as effecting its fusibility. In the ball when drawn, it is controlled largely by temperature at the time of going on high-boil and at the time of drawing; this temperature, at both periods, being chiefly governed by the damper. In the shingled ball, it is controlled by the amount of work or pressure; the cinder being generally smaller in amount when a hammer, than when a squeezer, is used. In the puddle bar, and in the finished product, it is dependent upon the reduction in area and the rapidity of this reduction. These conditions put the process thoroughly under the control of the operator.

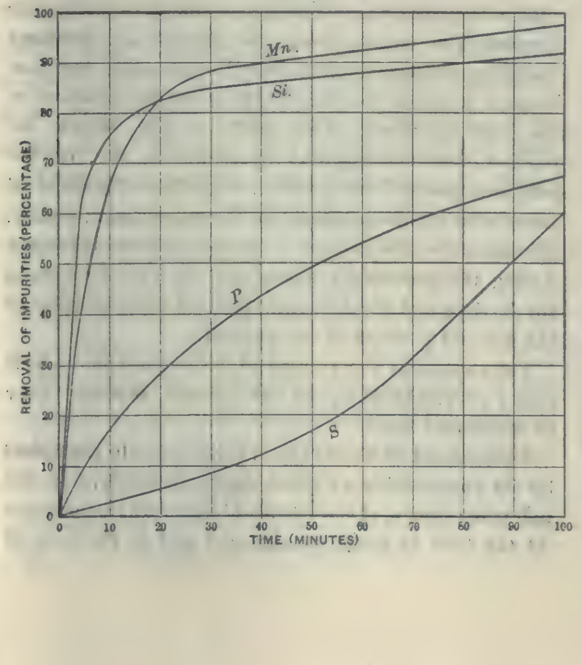
High cinder-contents are desirable for free welding, for such purposes as pipe-making, etc.; and low cinder-contents, when the product is to be subject to severe physical strain.

The order and proportions of the oxidation of the principal metalloids are shown in the diagram, fig, 1.

The object of agitation, which is ordinarily accomplished by the rabble, is, to produce as uniform conditions as possible throughout the bath; to bring into intimate contact the cinder and iron; and to prevent as far as possible the settling of the iron, in a partly refined condition, on the relatively cold bottom, and its becoming, as a consequence, too cold on the under side. This occurs in a measure during the "drop," particularly in large furnaces, and necessitates "turning."

Small heats, such as are still worked at Low Moor, are best adapted for uniformity of product; since the workman has not the physical strength and endurance to agitate the larger baths effectively, though he obtains material assistance from a good "high-boil." Another disadvantage in large furnaces is the necessity of starting to draw "young" since otherwise the later balls are subject to severe loss.

FIG. 1.



The irregularities thus produced are, however, largely overcome by the subsequent treatment of piling and reheating. Piling operates as a fairly efficient mixing by the natural law of chances; and reheating helps, by maintaining the iron at a temperature, and for a period, which permits both the oxidation of the carbon of the "young" iron and the reduction of some of the cinder present. Hence, the small pieces of which an iron pile is formed are desirable under existing methods of producing puddled iron. But piling has also its disadvantages, in the production of laminations, due to carelessness, or lack of means or skill, and in the high cost of handling loose piles.

THE STRUCTURE OF PUDDLED IRON.

By reason of decreased fusibility through the elimination of carbon, puddled iron crystallises at a lower temperature than steel. Each grain or crystal is surrounded by an envelope of cinder; which, when the clusters are dense, fills the intervening spaces. The greater part of this cinder is then hammered or squeezed out, and the succeeding operation of rolling elongates the crystals into what are commonly known as fibres; each fibre existing in a matrix of cinder. This fibrous formation in a matrix of ferrous silicate is the controlling characteristic of wrought iron, and the source alike of its virtues and its faults. The fibrous structure can be distinctly seen under the microscope at various powers, and often with the naked eye.

Many instances of the arrest of fracture by the fibre occur in the experience of most engineers with shafts, bolts, chain-hooks, etc. An illustration recently came under my observation. About two years ago, a shear cam-shaft, 9 in. in diameter by 48 in. between journals, was bent about 0·5 in. at one side of one of the two cams, producing a crack about 2 in. deep and open almost an eighth of an inch. The lateral movement of the large spur-wheel, due to the bend, was carefully noted and measured at frequent intervals to learn whether the fracture was extending. As it did not extend, and no convenient opportunity offered for straightening, the shaft ran till July of last year, when it was taken out, straightened and replaced. It is doing good work, and running true to-day. Had it been steel, it would have been necessary to take it out at once, and, after straightening, to anneal it; even then, a greater risk would have been run than with wrought iron. Drive-pipes for wells furnish another illustration. Wrought iron withstands the shock of driving at the threads, whereas steel breaks off at the root of the threads.

A blast-furnace plant of two stacks had an experience bearing upon this question. One stack was erected about thirty years ago, with a shell of wrought-iron plates; the other, about four years ago, with a shell of basic open-hearth steel plates. Both were evidently subjected to the same character of strains, and in approximately the same position. The wrought-iron shell bulged out under strain, but did not crack; while the steel shell suffered a vertical rupture extending about 20 ft., and not following to any marked degree the lines of the riveted joints.

Physical tests of steel made in the laboratory on an 8 or 10 in. section give results which superficially appear to be superior to those of wrought iron, particularly in the feature of elongation. But when studied with greater care the elongation is seen to be largely concentrated, and not so uniformly distributed throughout its length as is that of iron.

This tendency to concentrated elongation in steel, and to more widely distributed elongation in wrought iron, is shown in their respective tests, in full-sized sections, for eye-bars in bridges; the specified elongation being the same for iron and steel in a length of 10 ft. The following are results of such tests :—

	Elastic Limit.	Ultimate Strength.	Elongation, Per Cent.		Reduction of Area.
	lb. per sq in.	lb. per sq. in.	In 12 in.	In 18 ft.	Per cent.
Iron...	31,550	48,810	23	15·22	28·30
Steel..	33,150	59,260	39	14·40	51·50

There is greater general confidence in welded articles made of iron than of steel. This is well-founded: the cinder present in iron, and its low carbon-contents, naturally facilitate welding. This receives further confirmation from the fact, that as the carbon is increased in steel, the uncertainty of a good weld becomes greater.

RESISTANCE TO OXIDATION.

That wrought iron resists oxidation better than steel is becoming the general opinion of those who have studied the question under actual working conditions. The difference is naturally more apparent in thin objects, such as corrugated roof-sheeting, tin-plate for roofing and the like; but its influence is the same regardless of mass. The difference in the life of light sections is about as five to one in favour of puddled iron.

The explanation of this resistance to oxidation is as follows :—

The cinder, a ferrous silicate, enveloping each fibre, is much attenuated by rolling, and in that condition is elastic. A piece of iron fresh from the rolls is covered with relatively thick scale, which will readily crack off to a large extent, exposing a surface of iron fibres with its intervening cinder. These fibres oxidise somewhat rapidly, leaving a finely corrugated surface of cinder, which resists further atmospheric action, as may be seen in heaps of *scoriæ* from old hearths, believed to date from before the Christian era. Being elastic, it resists for considerable though varying periods; but eventually it cracks off under vibration, expansion, and contraction, or mechanical wear. The cycle is then repeated and so on.

Puddled iron is a mechanical combination of two substances, iron and cinder, which offer differing resistances to such pressure as that of rolls or hammers. The result is a rough surface, which forms a more lasting bond with any protecting agent, such as tin or paint, than the smooth surface of steel, which does not aid in any way the adhesive qualities of the protecting agent.

DEFECTS OF WROUGHT IRON.

Under this head, we have to consider transverse weakness, lower ultimate strength, laminations, and high labour-cost in production.

Transverse weakness is inherent, though less marked as the cinder-contents are reduced.

Lower ultimate strength and elastic limit, demanding (for the same factor of safety, and if the possible effects of the "pitting" of steel be ignored) a greater section for a given strain, is also an inherent weakness, so long as the product is made from built-up piles, requiring low carbon as an essential condition for good welding.

Laminations due to imperfect welding, are commonly the result of inefficient machinery, or lack of skill. This defect also is inherently associated with the use of built-up piles, especially when these are made, wholly or in part, from scrap of miscellaneous character. I recall an instance, in which a lot of 1½-in. "rounds" were ordered to be made for special bolts, from muck-bars only. While cutting them to length on the anvil, we noticed that, after superficial nicking, some pieces fell off even without bending. Upon investigation, the so-called "iron" was found to include pieces of hard steel rail, fairly well defined in form, and surrounded by soft wrought-iron, presumedly "muck-bar," which peeled off with the freedom of a banana-skin; the exterior and the core not being welded together.

The high labour cost of production is probably the principal cause which has checked, during recent years, the legitimate increase in the use of wrought iron. It is constantly receiving greater emphasis, as the younger generation of workmen with greater educational advantages, turns away from arduous manual toil, and particularly from the opprobrium attached to the term "puddler," as indicating a relatively servile and ignorant class. This stigma has existed from time immemorial in India, where the ironworker is ranked in the lowest caste. The severity of the work, together with the inferior social status of the worker, have depopulated puddling-mills in this country and England, and caused, in certain districts, the abandonment of puddling.

FUTURE FOR IRON PUDDLED BY MECHANICAL MEANS.

With the exception of relative transverse weakness, all the above short-comings of wrought iron are due to the method of manufacture, rather than to inherent qualities of product. Iron puddled in large masses by mechanical means, and rolled direct, as soft steel is, would give us fibrous structure; resistance to oxidation; high tensile strength; low cost, and the absence of laminations. Such a material would cover the field now jointly held by puddled iron and soft steel, even to the possible use of the latter for rails.

CONDITIONS ESSENTIAL TO SUCCESSFUL PUDDLING.

The conditions necessary to produce such iron are: (1) a large unit of manufacture; (2) adequate mechanical means; (3) cinder of proper composition; (4) a flame of the right composition and temperature; (5) a relatively permanent furnace-lining; (6) a relatively small loss of iron; (7) simplicity of means and method.

Conditions (1) and (2) are the chief factors (indeed, if we consider Bessemer steel alone, the only ones) in the low cost of steel-manufacture. These two conditions, introduced into the production of wrought iron, would have a like effect upon its cost. I will consider later the means of effecting this end.

As already shown, the right cinder for the puddling process is largely produced from, and corrected by, the oxides forming the sides and bottom of the hearth. It is, however, evident that the purer oxides of iron are inert while in position, and only become active after absorption into the bath. Hence, when suitable oxides are introduced in the form of cinder, ore, and roll-scale, there is no need of drawing upon the bottom and sides, provided these latter are of such nature as to resist the chemical action of the cinder and the temperature of the gases.

The proper regulation of the flame is essentially a simple matter, presenting difficulty only when associated with the motion of the furnace (if the latter be movable).

CONDITIONS TO BE MET BY THE LINING.

The lining offers a somewhat complex problem, both metallurgically and mechanically. It must resist the chemical action of a compound cinder; the friction of the mass as the iron comes to mature; and a somewhat high temperature. Moreover, in a mechanical furnace, it must maintain its position throughout the movements of the furnace itself.

The minimum loss of iron is secured by the reduction of some of the iron-oxide additions, resulting in an actual gain of weight of the puddled mass, over the pig charged, in an ordinary puddling furnace. This gain is exceeded by the final loss, due to the delay in the period of balling and drawing. By reducing the period of drawing, as by discharging the whole mass in one piece, this loss may be avoided, and a possible net gain effected.

Read before the American Institute of Mining Engineers.

OBITUARY.

The Times Berlin correspondent states that Professor Franz Reuleaux, the well-known engineering specialist, has died at the age of 76. As the author of a number of engineering works, and as director of the Berlin Industrial Institute, he rendered good service to the development of practical and scientific engineering in Germany.

Mr. Ernest Oscar Mawson, executive engineer in the Bombay Public Works Department, who died at Nasik, on July 29th, was joint author with Mr. Calthrop, of a valuable text-book on "Pioneer Irrigation and Light Railways." He was the inventor of several irrigation contrivances, the most important of them being his automatic gate for regulating the escape of water from tanks, rivers, and canals in flood times, which was described some time ago in these columns.

Admiral the Hon. Sir Arthur Cochrane, K.C.B., whose death has just occurred in London, was a son of the famous Lord Cochrane of naval fame. The late admiral joined the navy in 1840, and saw active service in the Crimean and China wars. He acted as superintendent of the Sheerness Dockyard from 1869 until 1873, and for the next three years was Commander-in-Chief of the Pacific Squadron. He was made an admiral in 1881, retired from the navy in 18 6, and was knighted in 1889. The late admiral took a practical interest in engineering, and was the inventor of a water-tube boiler which was fitted experimentally to several vessels, though it did not find permanent adoption in the navy.

NAVAL NOTES.

SUBMARINE B2, the second of the approved class of submarines, was launched at Vickers, Sons, and Maxim's yard on Saturday. Mrs. Lees, wife of Captain Thomas O. H. Lees, performed the ceremony. The A5, which has now been repaired at the same yard, will shortly leave for Devonport.

The cruiser *Eclipse*, which has been fitted for an additional training cruiser for naval cadets, attained a speed of 19·5 knots on her steam trials. The coal consumption is described as being of a most satisfactory nature, and the engines and the whole of the auxiliary machinery worked smoothly.

The new barracks which have been erected for the accommodation of the boys from several of the Admiralty training ships at Shotley, near Harwich, are rapidly nearing completion. The first batch of the 1,600 boys to be quartered there are expected in October. They will be accommodated in thirty-two buildings, in which dormitories and dining-rooms are combined.

The *Roxburgh*, cruiser, left the London and Glasgow Shipbuilding Company's yard at Glasgow on Saturday for Greenock, whence she will this week set out on her trial of twenty-four hours' continuous steaming. At her eight hours' full power trial, the mean power on the eight hours' steaming was 21,857. The steam pressure at the boiler was 204 lb., while the coal consumption was 2·3 lb. per horse-power hour.

The new French naval programme prepared by the Superior Council of the Marine provides for a total strength of 34 battleships, 18 first-class and 18 second-class cruisers, 109 destroyers, 49 submarines for coast defence, 82 submarines or submersibles capable of engaging in offensive operations, and 170 torpedo-boats, in addition to scouts and vessels in reserve. Whether the whole of this elaborate programme will be carried out is open to question, but next year 3 battleships, 10 destroyers, and 20 submarines are to be put on the stocks.

Details of the trials of the French cruiser *Leon Gambetta* are given by Le Yacht as follows: First trial: six hours, central engine only at 2,500 h.p., with four boilers (results not given). Second trial: eight hours, engines at 6,500 h.p. half the fires lighted, two lateral propellers working, speed 15 knots. The engines actually developed 7,116 h.p., giving a speed of 15.5 knots. Three-fourths of the personnel were engaged. Third trial: eight hours, engines at 11,000 h.p., three-fourths of the fires lighted Actual result: engines developed 10,559 h.p. only, giving a speed of 18 knots. Fourth trial: 24 hours, full power under natural draught. Result: 16,190 h.p., speed 20·5 knots. Before the fifth trial the *Leon Gambetta* steamed at fourteen knots during the clearing of her furnaces. Fifth trial: three hours at full speed with the engines at 25,500 h.p. Actual result: engines 25,720 h.p., speed 22·4 knots. Sixth trial: one hour with three-fourths of her fires lighted and steaming her utmost under these conditions. Result: 17,688 h.p., speed 20·5 knots.

The German battleships *Preussen* and *Hessen*, laid down in 1902, are reported to be ready. The cruiser *Roon*, begun the same year, is still under construction. The cruiser *York*, laid down in 1903, is ready for her trials, but with the battleships *Deutschland* and *Lothringen* not so much progress has been made. Of the ships begun in 1904 only the cruiser *Leipzig* has been launched. The vessels still on the stocks are the four battleships *O*, *P*, *Q*, and *R*; the two large cruisers *C* and *D*; the three small cruisers *O*, *Ersatz Alexandrine* and *Ersatz Meteor*; one transport for submarine mines; one transport for ammunition; and one surveying vessel.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

	Last Day.
Pontypridd.— Construction of tramway permanent way. Mr. Reginald P. Wilson, 66, Victoria Street, Westminster, S.W. ...	Sept. 2
Salford.—The supply, delivery, and erection of a water softening and purifying plant capable of dealing with 15,000 gallons of water per hour. — Borough Electrical Engineer, Pendleton	Sept. 2
Scarborough.—Construction and erection of a steel bridge over the Scarborough and Whitby railway, of 60 feet span, with masonry abutments and earthwork approaches, at Manor Road, Scarborough, for the North-Eastern Railway Co. Mr. W. J. Cudworth, the company's engineer, York	Sept. 4
Southampton.—Supplying and fixing at the Corporation Wharf, Chapel, three 18 in. high-pressure direct-acting centrifugal pumping engines, including all suction and delivery pipes, steam and other connections, for the Corporation. Mr. J. A. Crowther, A.M.Inst.C.E., borough engineer, Market Chambers, 123, High Street, Southampton	Sept. 4
London.—Construction and delivery, f.o.b. in London, Liverpool, or Birkenhead, of an iron lighthouse, with lantern and plate glass for the same, for the Corporation of Trinity House, London, E.C. The drawings may be inspected and forms of tender, etc., obtained at Trinity House, E.C., between 10 a.m. and 5 p.m. Tenders, marked outside "Tender for Kuala Selangor Lighthouse," must be addressed to Mr. A. Owen, secretary	Sept. 4
Neath.—Reconstruction of a bridge over the River Neath and Tennant's Canal, near Neath station, Great Western Railway. G. K. Mills, secretary, Paddington Station	Sept. 5
Bristol.—Construction, delivery, erecting in place, testing, and maintenance for 12 months of pumping machinery for the dry dock now in course of construction at Avonmouth, in the port of Bristol, for the Docks Committee. The contract includes steam engines, centrifugal pumps, steam-boilers, and all auxiliary machinery and piping for the complete installation. Mr. W. W. Squire, Cumberland Road, Bristol.	Sept. 11
Bishop's Stortford.—The Urban District Council invite tenders for supplying and fixing gas pumping engine, suction gas plant, and sewage pumps at their sewage pumping station. Mr. Thos. Swatheridge, clerk, Council offices, 7, North Street, Bishop's Stortford	Sept. 12

	Last Day.
Hull.—Construction and erection of the new steel swing-bridge over the River Hull at Sculcoates, on their Victoria Dock branch, and weighing about 450 tons, for the North-Eastern Railway Company. The contract will include the removal of the existing swingbridge, the raising of the public road, and the building of river walls, timber jetty, etc. Mr. W. J. Cudworth, company's engineer, York	Sept. 11
Chelmsford.—The Lighting Committee has been authorised to obtain tenders for lighting the streets and public clock with electricity, gas, or other illuminating power, for three or five years, from March 25th, 1906. Clerk	—

COMING CONTRACTS

Southend - on - Sea.—The Council have decided to extend the municipal tramways along the beach to Shoeburyness, and to build a sea wall and promenade, involving a total expenditure of over £60,000.

Bath.—It is proposed to rebuild the old Midland Bridge at the destructor yard at an estimated cost of £2,000.

Gainsborough. — A sub-committee has been appointed to report upon a site for a refuse destructor. The engineer recommends improvements in the water supply at an estimated cost of £2,171.

CONTRACTS CLOSED.

Wimbledon.—The Town Council have accepted the tender of Ed. Bennis and Co., Ltd., Little Hulton, Bolton, for three sets of "Bennis" stokers and compressed air furnaces, together with shafting brackets and motor of the Witting-Eborall type, for their water-tube boilers.

Manchester.—The Corporation have accepted the tender of Messrs. Veritys, Ltd., for their "Aston" motors, for the 2, 3, and 4½ h.p. sizes.

Stockport.—The tender of Ed. Bennis and Co., Ltd., has been accepted by the Town Council for four sets of "Bennis" stokers fitted with natural draught self-cleaning furnaces.

Scunthorpe.—The Hart Accumulator Company, Ltd., have secured the order for a storage battery of 122 of their Standard Lighting type cells, required by the Urban District Council.

Dublin.—The Corporation have placed with Ed. Bennis and Co., Ltd., a contract for ten sets of self-cleaning compressed air furnaces for their Pigeon House Fort generating station.

Suffolk. — The tender of Messrs. Tamplin and Makovski, Ltd., of Ipswich, has been accepted by the County Council for installing the electric light in the new county buildings, at £152.

Bath.—Mr. C. Wibley, Bath, has secured the order for alterations and additions at the Corporation Electricity Department.

Grimsby.—The Council have accepted the tender of A. C. Dickins and Co. for wiring the new highways yard.

Liverpool.—Messrs. C. and A. Musker, of Liverpool, have received an order from the Mersey Docks and Harbour Board for the sluice machines, gate machines, and capstans.

Brighton.—The Town Council have accepted the tender of the Transporter Company, Ltd., for the supply, erection, and maintenance, for a year, of a coal-handling plant at the Southwick Power Station, at £2,321.

Watford.—The Urban District Council have given an order for a year's supply of alternating current transformers to the Brush Electrical Engineering Company.

Islington.—The Borough Council have accepted the following tenders: Willans and Robinson, one 1,500-k.w. steam turbo-generator, exciter, condensing plant, etc. (the alternator to be of Dick-Kerr's manufacture), £8,258; Balcke and Co., one natural-draught cooling tower in two sections, £1,118; John Spencer, Ltd., 800 ft. of 20 in. diameter steel riveted pipe for circulating mains, together with 12 bends of the same diameter, £466 12s.

Dimbledon.—The British Thomson-Houston Company have received an order for a 1,000-k.w. turbo-alternator from the Dimbledon Urban District Council.

Loughborough. — The Buenos Aires and Pacific Railway have placed an order with the Brush Electrical Engineering Company, Ltd., of Loughborough, for one 500 and two 250 k.w. turbo-alternator sets, each consisting of Brush-Parsons steam turbine direct coupled to synchronous alternator by means of flexible coupling.

Cleveland. — The Brush Electrical Engineering Company, Ltd., have received an order for electric locomotive from Cleveland and County of Durham E.P.D. Co. (per Messrs. Bramwell and Harris).

Derby.—The Chain Belt Engineering Company, Derby, have received an order from the Dunderland Iron Ore Company, Ltd., for a complete conveying and loading plant, capable of handling 130 tons of iron ore briquettes per hour; the plant includes three elevators, a slat conveyor, and five pan conveyors, one of the latter being 800 ft. long.

Burton-upon-Trent.—The following tenders have been accepted for alterations and additions to the electric lighting, and also for alterations to be made to the heating apparatus at the town hall: Gough and Felgate, Uxbridge Street, Burton-upon-Trent, heating, £138 14s. 9d.; J. Richards, High Street, Burton-upon-Trent, electric lighting, £199.

APPOINTMENTS VACANT.

London.—Chief instructor in mathematics in Northampton Institute, St. John's Street Road, E.C. Salary £150 per annum. Particulars of R. Mullineux Walmsley, D.Sc., Principal ... ... Aug. 30

Newport.—Assistant in Borough Engineer's Department. £120. Mr. R. H. Haynes, borough engineer, Newport ... ... Aug. 28

Belfast.—Assistant lecturer in electrical engineering at the Municipal Technical Institute, Mr. Fras. C. Forth, director of technical instruction... ... ... Aug. 29

Crawford.—Teacher of mechanical engineering for the Crawford Municipal Technical Institute, Cork. Salary £200 per annum. Also an assistant for evening classes. Salary £100 per annum. Mr. E. A. O'Keefe, B.E., M.I.E.E., principal ... Aug. 31

Edinburgh.—Lecturer in electrical engineering in the Heriot-Watt College, Edinburgh. Salary £150 per annum. Applications to P. MacNaughton, Heriot Trust Offices, 20, York Place, Edinburgh. Sept. 3

Derby.—County surveyor for the Derbyshire County Council. £500. Mr. N. J. Hughes-Hallett, clerk... ... ... Sept. 6

Bristol.—Assistant lecturer and demonstrator in engineering is required at the Merchant Venturers' Technical College, Bristol. Salary £170. Registrar... ... Sept. 18

Handsworth, Staffs.—Station Superintendent and an assistant engineer for the Council's electricity works. Salaries £120 and £100 per annum respectively ... Sept. 30

APPOINTMENTS FILLED.

Queenstown.—The Queenstown Town Council (Cape Colony) have engaged Mr. Gellatly, of King Williamstown, for two years, at a salary of £1,000 per annum, to take entire charge of the construction of the Bongolo reservoir, recently provided for by Act of Parliament.

East London.—Mr. J. Mordey Lambe, of Kimberley, has been appointed borough electrical engineer by the East London (South Africa) Town Council.

Johannesburg. — The Municipal Council have appointed Mr. J. A. McMullen station engineer.

Wednesbury.—Mr. W. Fennell has been appointed manager of the Wednesbury electricity undertaking at a salary of £180 per annum.

Clydebank.—Mr. George D. Mackie, surveyor and water engineer of Crieff, has just been appointed engineer to the Clydebank and District Water Trust.

Rugby.—Mr. D. P. Thomson has resigned his position as chief designer of the continuous-current section of the British Thomson-Houston Co., Rugby, in order to take up a post with the General Electric Co., of Schenectady, N.Y.

Greenwich.—Dr. J. B. Henderson, who is at present lecturer in electrical engineering and senior demonstrator in the James Watt laboratories, Glasgow University, has been appointed professor of applied mechanics in the Royal Naval College, Greenwich.

Kettering. — Mr. F. J. Bakewell has resigned the position of electrical engineer to Kettering Council, and the chief assistant, Mr. W. A. Walker, has been appointed to succeed him.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols: Sept. 1st. General Settlements: August 31st, September 14th, 28th. Bank Rate, March 9th, 1905, 2½ per cent

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅜— 2½
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4½— 5
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3¼ — 3⅜
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜— 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102½—104½
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	2/4⅘	Babcock and Wilcox, Ltd., Ord.	1	3½— 3¾
100,000	1	7⅕d.	Do. „ 6% Cum. Pref.	1	1½— 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾— 5¼
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½	2/8⅗	Barrow Hæmatite Steel Co., Ld., O.	4½	$1\frac{3}{16}$— $1\frac{5}{16}$
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛— 4⅜
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd. 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104 —106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾— 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100—102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	$\frac{9}{32}$—$\frac{13}{32}$
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	$\frac{9}{16}$—$\frac{11}{16}$
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	93 —96
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	$\frac{31}{32}$— $1\frac{1}{32}$
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	$\frac{17}{32}$—$\frac{19}{32}$
1,160,000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	$1\frac{3}{16}$— $1\frac{5}{16}$
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅝ — 1¾
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11½—11⅞
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord.	5	8⅞— 9⅛
232,500	5	2/6	Do. 5% Cum. Pref.	5	5½— 5¾
450,000	1	1/2⅖	Clayton & Shuttleworth, Ltd., Ord.	1	$\frac{15}{16}$— 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5¼— 5½
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	100 -102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.	7½	31½— 32½*
57 031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	15⅝—16
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾—11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	$\frac{17}{32}$—$\frac{19}{32}$
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	90 —94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3¼— 3¾
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord.	1	⅝—¾
300,000	1	7⅕d-	Do. 6% Cum. Pref.	1	$\frac{13}{16}$ -$\frac{15}{16}$
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½— 9½
69,754	13	10/-	Do. do. do.	10	6¼—6¾
20,250	10	8/-	Elliott's Metal, Ltd.	8	5¼— 5¾
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾— 9¼
186,748	Stk	4%	Do. Deb. 4%	100	90— 94
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	11 — 11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd, Ord. Nos. 1/9000	10⅛	12¼—12½
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10⅛
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	3¾—4¼
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5½— 6
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Red.	100	88½—89½
16,800	10	10/-	Greenwood & Batley, Ltd., Ord.	10	7 — 7¼
9,600	10	7%	Do. 7% Cum. Pref.	10	10 — 10½
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	$2\frac{5}{16}$— $2\frac{7}{16}$
344,000	5	2/6	Do. 5% Cum. Pref.	5	6¼— 6½
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 —107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	$3\frac{7}{16}$— $3\frac{9}{16}$
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½— 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	$\frac{11}{16}$ — $\frac{13}{16}$
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	97— 99
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	5 — 5½
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	$\frac{11}{16}$—$\frac{13}{16}$
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅞—5½
£100,000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	98—100

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing rices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord.	1	$1\frac{7}{16}$— $1\frac{9}{16}$
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	12¾—13¼
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	95 —98
37,500	10	20	Kynoch, Ltd.	10	17 —17½
49,537	10	5%	Do. Cum. Pref. 5%	10	10½—10¾
300,000	1	4⅗d.	Lambert Bros., Ltd., Ord.	1	⅜— ½
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1⅗	Leeds Forge Co., 7% Cum. Pref.	3	4 — 5
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	$1\frac{5}{16}$— $1\frac{7}{16}$
£300,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref.	10	11½—12
210,000	1	8⅗d.	Measures Bros., Ltd., Ord.	1	½— ¾
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	¾ — ⅞
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21,943	5	2/6	Muntz Metal, Ltd.	5	4½— 5
14,248	5	5%	Do. Pref. 5%	5	4⅞— 5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	79 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅛—12⅜
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	88 — 91
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3¼— 3¾
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	6¼— 6¾
70,000	10	10/-	Pease & Partners, Ltd., Ord.	10	9½—9¾*
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	99 —102
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4⅞— 5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	6/- — 6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	4 — 4½
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	⅜ — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅝— 1⅞
73,062	5	2/-	Do. New	5	1½— 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red.	100	99—101
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000	1	$\frac{13}{16}$— ⅞
£350,000	1	7⅕	Do. 6% Cum. Pref.	1	$\frac{15}{16}$— $1\frac{1}{16}$
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	94 — 97
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	10 —10½
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	⅝ — ¾
300,000	1	7⅕d.	Do. 6% Cum. Pref.	1	⅞— 1
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	93 — 95
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red	100	93 — 96
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	95 — 99
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	¾ — ⅞
300,000	1	1/2⅗	Do. 6% Cum. Pref.	1	$\frac{13}{16}$— $\frac{15}{16}$
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	92 — 95
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560	5	$5\frac{15}{16}$—$6\frac{3}{16}$
£125,240	Stk.	5%	Do. 5% Trust Mort. Deb.	100	105—106
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2 — 2¼
25,000	10	5/6	Do. 5½% Cum. Pref.	10	3⅞— 4⅛
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	80— 85
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	17¾—18¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½— 15
684,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾ — ⅞
538,845	1	6d.	Do. 5% Cum. Pref.	1	$\frac{15}{16}$— $1\frac{1}{16}$
£240,000	Stk	4¼%	Do. 4¼% 1st Mort. Deb. Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	⅝ — ¾
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	79 — 83
£148,500	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. Or.	1	⅝ — ⅞
£160,000	1	7⅕d.	Do. do. 6% Cum. Pref.	1	$\frac{15}{16}$ — $1\frac{1}{16}$
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼— 9¾
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	37 — 37½
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	107—107½*
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	99 —101
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord.	1	2⅜—2½
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	$1\frac{3}{16}$— $1\frac{5}{16}$
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock,	100	120 —123
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104 —106
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 —108
225,000	1	1/2⅗	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	$\frac{13}{16}$— $\frac{15}{16}$
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord.	1	⅞— 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	86 — 88
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4½— 4¾
300	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2½— 3½
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	73 — 78
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	74 —76

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount bscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	8	1/9⅗	London Elec. Supply Corp., Ld., Ord.	8	2 —2½
60,000	5	3/-	Do. 6% Pref.	5	5 — 5½
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 -102
100,000	10	5/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	9⅞—10⅜*
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5½— 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	98 —100
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99—101%
10,852	10	8/-*	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14 — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6⅛— 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13½—14½
20,000	5	3/6	Do. 7% Pref...	5	8½— 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 —99
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅜— 2⅞
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	76 — 80
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	$\frac{13}{16}$—$\frac{15}{16}$
50,000	1	8⅗d.	Do. 7% Cum. Pref.	1	$1\frac{5}{16}$—$1\frac{7}{16}$
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	106 —109
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅝— 4⅞
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛— 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	105—107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½—13¼
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛ —6⅜

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	3½ — 4
£763,580	Stk	14/-	Anglo-American Tel. Co.. Ltd., Ord.	100	59 — 61
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	106 —107
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	14¾— 15
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7⅛— 7⅜
$15,000,000	$100	[illegible]	Commercial Cable Co., Capital Stk.	$100	———
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96½—98½
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾— 9¼
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	9¼— 9¾
£30,000	50	4½%	Do. 4½% Debs...	50	100-103%
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	11½—11¾
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	99—101
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101—103%
900,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13¾—14¼
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105—107
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	142 -145
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	90½—92½
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	107½ —109½
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 —36
£58.700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99—101
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	51½— 53½
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	¾— ⅞
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	109½—110½
£1,966 667	Stk	5%	Do. Deferred	100	107 —109
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅝ — 5⅞*
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	99½—101⅛
£689,[illegible]93	Stk	4%	Do. 4% do. do. ..	100	104 –106
179,313	1	8⅗d.	Oriental Telephone & Elec. Co., Ltd.	1	$1\frac{3}{16}$— $1\frac{5}{16}$
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛—1¼
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	98 —101
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7½— 8
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6¼— 7¼
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛— 5⅜
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	109—111
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	8¾ —9¼
£30,008	2½	—	West Coast of America, Ltd. ..	2½	½ — ⅝
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100—102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅜ — ⅝
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8½— 9¼
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6 — 6½
£80,000	100	5%	Do. 5% Deb.	100	101 —104
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13¾—14¼
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	100 —102
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	102 —104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8¾— 9¼
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100—102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	95 — 97
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11⅜— 12¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	102—104
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1¼ — 1½
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	7¾— 8¼
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 — 88
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	129 —132
£1,160,000	Stk	19%	Do. do. Deferred ..	100	226 —229
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	35 — 36
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8½— 9
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60.000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1⅛ —1¼
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	126 —131
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	¼ — ⅜
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅜ — ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ —1¼
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	$1\frac{1}{16}$—$1\frac{3}{16}$

RAILWAY CARRIAGE & WAGON COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22¾—23¼*
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¾— 9¼
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13¾—14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9¾— 10
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	2¼— 2¾
4,150	10	5%	Do. do.	10	10⅛—10½
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/ -43/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/9--24/3
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28/6-- 29/
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	18 —19*

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ — ⅞*
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16 — 9/16
120,000	1	1/2⅔	Bell's Asbestos Co., Ltd.	1	15/16 — 1 7/16
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½ — 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½ — 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	102 — 105
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100 — 102
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2⅜ — 2⅝
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red. ..	100	85 — 89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord. ..	2	½ — ¾
150,000	2	2/4⅘	Do. 6% Pref.	2	1¼ — 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk. ..	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	78 — 81
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10 — 11
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½ — 5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	107 — 109
85,000	3	1/6	Crompton & Co., Ltd.	3	1½ — 2
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	94 — 99%
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¾ — 8¼
61,000	5	8/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 — 107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 — 109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅛ — 1⅜
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	83 — 88
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89 — 94
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	½ — ¾
31,390	2	2/9⅗	Do. 7% Cumulative Pref. ..	2	1¾ — 2¼
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92 — 95
10,248	10	7/6	Evered and Co., Ltd.	10	10 — 12
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97 — 101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½ — 12½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109 — 111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15 — 16
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 — 103
7,500	10	—	Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3 — 16/9
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	32 — 34
£150,000	100	4%	Do. 4% Deb. Bonds	100	102 — 104

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¾ — 9
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅞ — 6⅛
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141 — 144
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13¾ — 14¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½ - 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98 — 101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 — 102
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	13/16 — 15/16
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	13/16 — 1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	4 — 4½
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	95 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	109 — 112
		5%	Pref. Ord. Stock	100	102 — 105
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	8⅛ — 8⅜
156,437	10	6/-	Do. 6% Cum. Pref.	10	10¾ — 11¼
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	122 — 124
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red. ..	100	97 — 99
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3 — 3¼
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5½ — 5¾
27,000	5	3/-	Do. "B" do.	5	4¾ — 5¼

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96 — 98
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	100 — 103
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9½ — 10
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107 — 109
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅜ — 1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ —
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 — 102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103 — 105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½ — 14½
59,987	10	6/-	Do. 6% Pref.	10	15 — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2½ — 3
£150,000	Stk	4%	Do. 4% Deb. Stock	100	83 — 88
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9¾ — 10¼
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99 — 102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	102 — 104
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	¼ — 5/16
500,000	1	6d.	Do. 5% Cum. Pref.	1	1 — 1 1/16*
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105 — 107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1½
110,923	8	3/2⅔	North Metropolitan Tramways Co. ..	8	4½ — 4¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	93 — 98
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red. ..	100	103 — 106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾ — 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9 — 9½*
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101 — 104

IV.—ELECTRIC LIGHTING AND POWER.

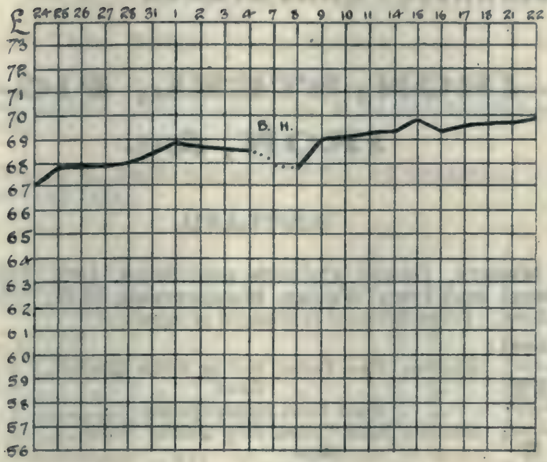
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾ — 12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9¾ — 10¼*
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12*
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	105 — 107
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	104 — 107
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10 — 10½*
12,493	5	3/6	Do. 7% Cum. Pref. Shares ..	5	9⅝ — 10¼*
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord. ..	5	9 — 9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103 — 106
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	6¾ — 7¼*
80,000	5	2/3	Do, do. 4½% Cum. Pref. ..	5	5¼ — 5¾*
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103 — 105
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6⅛ — 6⅝
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 — 110
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	10½ — 11
40,000	10	6/-	Do. 6% Cum. Pref.	10	13 — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 — 127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 — 105
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	8½ — 9*
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111 — 114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¾ — 6¼
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 1/16 — 6 9/16
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	105 — 108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85 — 90
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5¼ — 5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	99 — 102
15,000	10	—	Havana Electricity Co., Ltd.	10	9½ — 10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7¾ — 8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100 — 103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	¾ — ⅞
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	11¾ — 12¾

Stocks and Shares marked * are quoted ex-dividend.

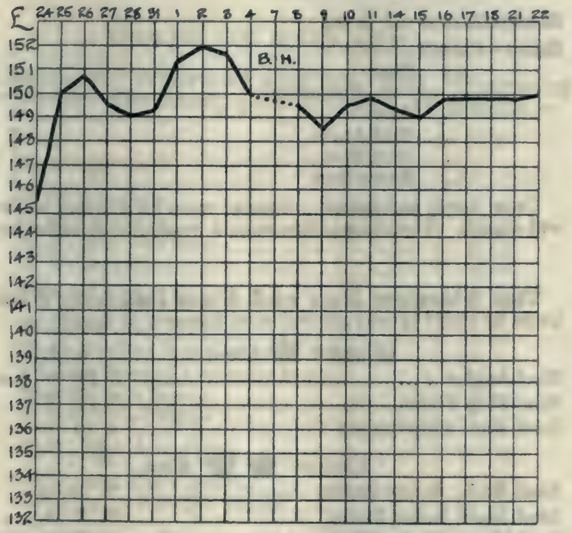
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JULY 24TH TO AUGUST 22ND, 1905.

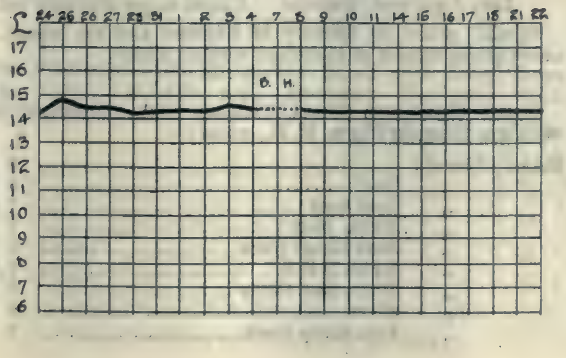
COPPER.



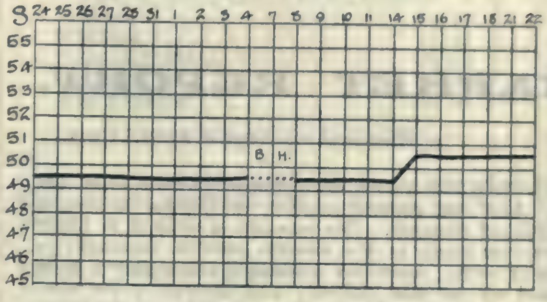
TIN.!



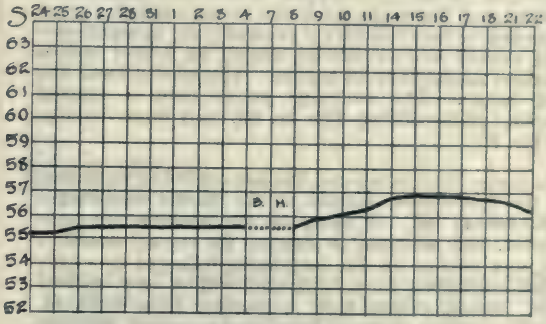
ENGLISH LEAD.



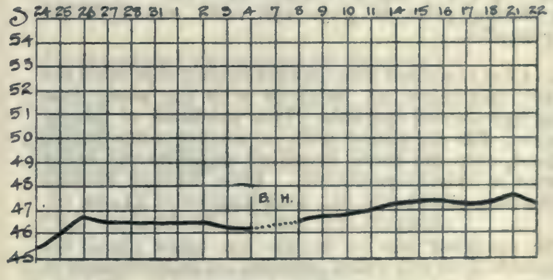
PIG IRON: SCOTCH,



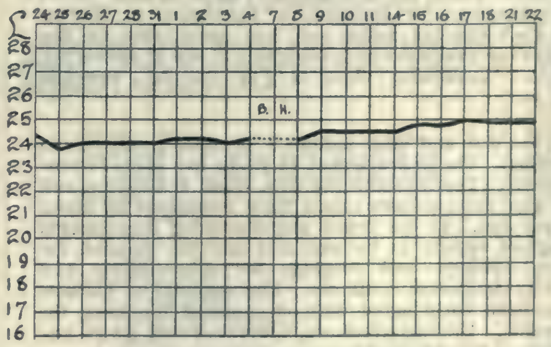
HEMATITE,



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, August 23rd, 1905.

ALTHOUGH values have receded a little from the best the present position of Copper is one of exceptional strength. The scarcity of refined is likely to become acute in the autumn months, especially in superior sorts. American producers are reported to be cleared out for near delivery and apparently the consumption of the metal has temporarily at least outstripped the output. Unrefined copper is the only metal at all plentiful, but the stocks are under strong control, a great proportion of the Chili bars at present lying in warehouse being already sold for delivery during the winter months to makers of sulphate of copper. The market looks like going better. This evenings prices show a marked advance, cash realising £70 2s. 6d. and three months £69 17s. 6d.

On lower Eastern advices Tin has exhibited weakness, and the speculative element in the market shows signs of slackening off. A study of the position suggests, however, that attempts to depress the market would be futile, any decline for the best being followed by a rally so that quotations have fluctuated within very narrow limits. Steady orders from consumers have come in, and all offerings of metal have been absorbed, with the result that some tired holders have been eliminated which ought to strengthen the market to a certain extent. The closing price is £150 15s. cash, and £150 5s. three months.

Lead has remained firm, dealers having supported the market and taken all offerings with the result that prices have moved upwards. This condition of things, however, has coincided with a smaller consumptive demand, only the more presssing requirements being covered at ruling quotations. Fine Foreign finished this evening at £13 17s. 6d., with English at £14 2s. 6d.

The predicted rise in Spelter has taken place, the favourable factors to which attention has been directed in this column having made their influence felt. The rise has been mainly brought about by large buyers' orders for galvanisers. Considerable quantities, as Merton and Co.'s circular points out, has been taken off the market and producers have been able to sell at advancing prices. Ordinaries close at £24 17s. 6d., Specials £25 5s.

In the Iron and Steel section a stronger position is to be noted. The improvement in trade has made further progress. The hematite pig iron trade is steadier, and pig iron makers have raised their quotations by about 1s. per ton. In the heavy manufacturing departments prospects appear to be excellent and the demand for heavy castings and forgings for shipbuilding and railway equipment continues. The speculative markets have been fairly active with an upward tendency for warrants. Closing prices are, Cleveland cash £2 7s. 3d., Scotch £2 10s. 6d., and hematite £2 10s. 3d.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality	6	15	0
♛♛	,, ,, ,, Land ,, ,,	6	17	6
STEEL	,, Steel Bars, Boiler Quality	7	0	0
DALZELL	Siemens' Steel Plates, Ship Quality Plates	5	17	6
♛	,, ,, Bars ,, ,,	6	10	0
STEEL	,, ,, Angles	5	10	0

Manufactured Iron :

	£	s.	d.
Bars—Dalzell	6	5	0
,, Best	6	15	0
,, ,, Horseshoe	6	15	0
,, Angle	6	5	0
,, Best Angle	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

(Glasgow ♛ Steel)	£	s.	d.	
Steel Angles	5	10	0	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	10	0	,,
Glasgow ♛ ♛ Steel.				
Steel Bars, Boiler Quality	7	0	0	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:

	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	—			2	14	0
Gartsherrie ,,	2	18	0	2	13	0
Summerlee ,,	2	17	6	2	13	0
Carnbroe ,,	2	15	0	2	12	0
Langloan ,,	3	0	0	2	15	0
Calder ,,	2	18	0	2	13	0
Clyde ,,	2	17	6	2	12	0
Glengarnock, f.o.b. Ardrossan	2	17	6	2	12	6
Eglinton ,, ,,	2	13	6	2	11	0
Dalmellington, ,, Ayr	—			2	12	0
Shotts ,, Leith	2	18	0	2	13	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♔ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♔	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♔ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
♔	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
♔	Hoops	7	0	0	7	10	0
W.I.W	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,, ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	12	0	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	0	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18¾ by 14 124s. 110 lb. "BV"	0	12	4½
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	4½
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	8

Charcoal Tinplates:

	£	s.	d.
C 20 by 14 112s. 108 lb. "Allaway"	0	12	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	16	0	per ton.
Billets	at 3	18	0	,,
Sheet Bars	at 4	0	0	,,

Finished Steel:

	£	s.	d	
Bars	at 5	0	0	per ton.
Angles	at 5	1	0	,,
Tees	at 5	5	0	,,
Joists	at 4	12	6	,,
Fencing Standards	at 5	3	0	,,
Shoeing Bars	at 5	5	0	,,
Tyre Bars	at 5	5	0	,,
Half-Round Bars	at 5	10	0	,,
Heavy Rails	at 5	5	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.		
English Ingots, f.o.b. Dis. 1¼% & 1%	150	0	0	to	150	10	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	151	0	0	to	151	10	0	,,
Straits G.M.B., cash Warehouse, Net	150	0	0	to	150	2	6	,,
Straits G.M.B., 3 months, Warehouse, Net	149	7	6	to	149	10	0	,,
Australian, Mt. Bischoff, Warehouse, Net	150	5	0	to	150	15	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	69	15	0	to	69	17	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	69	13	9	to	69	15	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	73	5	0	to	73	10	0	,,
English, Best Select, Warehouse Net	74	15	0	to	75	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	83	0	0	to	84	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	79	0	0	to	80	0	0	,,
Electro, Warehouse, Net	74	15	0	to	75	0	0	,,
Ore, ex. ship	0	12	9	to	0	13	9	per unit
Regulus, Matte and Precipitate, ex ship,	0	13	9	to	0	14	6	,,

YELLOW METAL.

Yellow Metal:

	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6½	per lb.
Sheathing ,, ,,	0	0	6⅝	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	15	0	to	24	17	6	per ton.
Blende of 50 % Net	6	10	0	to	6	15	0	,,
Calamine, Net	6	15	0	to	7	0	0	,,

LEAD

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	14	5	0	to	14	7	6	per ton.
Spanish, ex ship, Dis. 2½%	13	17	6	to	14	0	0	,,
Lead Ore of 70%, Net	7	5	0	to	7	7	6	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½%	62	0	0	to	63	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	16	10	0	to	18	0	0	,,
Crude, ex ship, Dis. 2½ %	37	0	0	to	40	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	2	6	per flask
Italian ,, ,, ,,	7	0	0	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	1	0

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal:

STEAM.

	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.

	s.	d.
London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

STEAM.—TOP HARD.

	s.	d.
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	$2\frac{1}{4}$	per lb.
	Picric, Crystals	0	0	10	,,
	Tartaric at Manchester	0	0	$10\frac{7}{8}$	,,

		£	s.	d.	
Acetate of Lime:	Brown at Manchester net	8	10	0	per ton.
	Grey ,,	11	12	6	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	$3\frac{5}{8}$	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	11	3	,,
Arsenic:	Best White Powdered net	12	10	0	,,
Bleaching Powder,	35% ,,	4	10	0	,,
Borax:	British Refined Crystal ,,	12	0	0	,,
Coal Tar Products:					
	Benzole, 50/90 % ,,	0	0	6	per gal.
	,, 90% ,,	0	0	7	,,
	Carbolic Acid Crystals, 34/35° C. ,,	0	0	$5\frac{3}{4}$	per lb.
	,, ,, ,, 39/40° C. ,,	0	0	$6\frac{1}{4}$	,,
	,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
	,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	8	,,
	Creosote, ordinary good liquid ,,	0	0	$1\frac{7}{16}$	,,
	Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
	,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
	,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
	,, ,, 90 % at 190° C. ,, ,,	0	0	10	,,
	,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
	,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	0	,,
	Naphthalene, all qualities.				
	Pitch f.a.s. Manchester. ,,	1	7	6	per ton.
Copperas:	Green, in bulk ,,	0	12	6	,,
	,, barrels f.o.b. L'pool ,,	1	17	6	,,
	Cake ,,	1	2	6	,,
Copper:	Sulphate	21	0	0	,,
Cyanides:	98% minimum f.o.b. net	0	0	$7\frac{1}{2}$	per lb.
Lead:	Acetate (Sugar) White, English	27	10	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K	23	5	0	,,
	,, ,, Grey	21	15	0	,,
	,, ,, Brown at Manchester	16	15	0	,,
	Nitrate	24	10	0	,,
	Litharge, Flake	16	10	0	,,
	,, Powder	17	0	0	,,
	Red Lead, Genuine, c.i.f. London less 5%	16	0	0	,,
	White ,, ,, Dry ,, ,, ,,	17	0	0	,,
Naphtha (Wood):	Miscible, 60 o.p.	0	2	6	per gal.
	Solvent	0	2	7	,,
Potash:	Bichromate... delivered England	0	0	3	per lb.
	Carbonate, 90/92 % ... c.i.f Hull	18	0	0	per ton.
	Caustic, 75/80 % ,, ,,	20	10	0	,,
	Chlorate net	0	0	$3\frac{1}{16}$	per lb.
	Montreal in Store, Liverpool	31	10	0	per ton.
	Prussiate Yellow net	0	0	$4\frac{7}{8}$	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
	,, ,, ,, Refined ,,	6	5	0	,,
	,, Carbonated, 48 % ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % net	6	10	0	,,
	Caustic, White, 77 % ,,	10	12	6	,,
	,, ,, 70 % ,,	9	12	6	,,
	,, ,, 60 % ,,	8	12	6	,,
	,, Cream, 60 % ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate net	0	0	$3\frac{1}{16}$	per lb.
	Nitrate...ex quay Liverpool, ... ,,	10	5	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)	1	12	6	,,
	,, (Saltcake, 95%)	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall; stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre:	French JC f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk) c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	0	to	0	13	0	per unit.
Regulus, 45 to 55%	0	13	3	to	0	13	9	,,
Precipitate, 65 to 80% ...	0	13	4½	to	0	13	10½	,,
Tin Ores, 70 %	91	0	0	to	93	0	0	per ton.
Lead Ore, 70%					6	19	0	,,
Blende, 50%					6	9	6	,,
Calamine					6	12	0	,,
Antimony Ore, 50%	20	0	0	to	22	0	0	,, nom.

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%,	f.o.b.	Porman	6	4	per ton.
Do.	,,	Cartagena	6	7	,,
Special low phos,	,,	Porman	6	10	,,
Do. do.	,,	Cartagena	7	0	,,
Extra quality do.	,,	,,	7	6	,,
Special Iron Ore	,,	,,	nominal		,,
Specular 58% do.	,,	,,	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	2	6		7	7	6
Nova Scotia Spruce	,,	7	0	0		7	5	0
Spruce Boards	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	
East India Teak	per load	12	0	0		16	0	
Greenheart	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak	,,	0	2	6		0	3	0
Norway Spars	,,	0	1	2		0	1	9

Deals.

Red Archangel and Onega, 1st quality	per std	19	0	0	20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0	16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0	12	10	0
St. Petersburg, 1st quality...	,,	16	0	0	17	10	0
Do. 2nd ,, ...	,,	14	0	0	15	0	0
Gefle	,,	11	10	0	16	0	0
Wyburg	,,	11	0	0	12	10	0
Uleaborg	,,	10	0	0	12	10	0
Gothenburg	,,	11	0	0	16	0	0

OPENINGS FOR TRADE ABROAD.

Paraguay.

An electric light and power supply undertaking is being established at Asuncion, a local company having obtained a concession.

Germany.

The municipal authorities of Mainburg, Bavaria, are about to invite tenders for the establishment of a central electric lighting and power station in the town, at an estimated cost of £4,100.

Italy.

The Government has sanctioned the expenditure of £14,000 by the Italian Ministry of posts and telegraphs, on the installation of telegraph and telephone wires in the Simplon Tunnel, to connect the Brique with Iselle.

Spain.

Tenders, which will be opened on the 16th prox., at the offices of the Port Works Board, Huelva, are invited for the supply of a locomotive tender for use at the iron wharf of that port, in accordance with plans and conditions on view at the offices of the Board, 14, Vázquez López, Huelva. A deposit of £50 is required to qualify any tender.

Mexico.

A concession has been granted to Mr. M. C. Miller for the construction and working, for eighty years, of a railway (1·435 metre gauge) from Guadalajara to Chamela, with a branch line to La Soledad, in the municipality of Zapopan. Five years are allowed for the free importation of materials and goods referred to in Article 74 of the Railway Law.

Argentina.

The Argentine Congress recently sanctioned the expenditure of £400,000 on various purchases for the navy of that country, including one transport vessel of 2,000 tons, two of 600 tons each, and four of 160 tons each, and a steamer for placing automatic mines. A variety of naval stores, such as condensers, boilers, tubes, ammunition, giroscopes, telescopes, compasses, sextants, materials for electric and radio-telegraphy, dynamos, etc., are also to be purchased.

Guatemala.

In the imports into Guatemala during last year electrical apparatus and material stand for £7,416, United States and Germany dividing the trade between them. No British firm is locally interested in the various electrical companies operating in this country. There is one tramway company in the city of Guatemala owning a horse-drawn service. This company has been granted a concession for working the line electrically, and the water power of the river Las Vacas is to be utilised in the generation of electrical energy.

Spain.

The Directorate-General of Public Works, Madrid, invites tenders for the concession of an electric tramway in Zaragoza. An application for this concession has already been made by the Zaragoza Tramways Company, who, at the same rates, will enjoy certain preferential rights over other tenderers. The competition will turn, in the first place, on the reduction of the tariffs proposed; and if two or more identical propositions are made, a further competition will take place verbally as to what reduction (if any) of the period (sixty years) of the concession tenderers may be prepared to accept.

Argentina.

Concessions for the construction of new railway lines have been asked for in Congress. The engineer, Horacio Anasagasti, formerly Argentine delegate to the St. Louis Exhibition, proposes to construct 1,900 kilometres of alternative electric and steam traction lines, and with the gauge of the tramways 1·44 metres. One line will start from the Central Produce Market, Barracas, to Santa Catalina, San Vicente, Bonnement, Ayacucho, and Mar del Plata; from Bonnement another line will cross Santa Rosa to Bahia Blanca; from San Vicente a branch will reach the La Plata Port, and another branch from Bonnement will go to the San Borombon Port. A further line will start from the Riachuelo, Barracas, to Merlo, and between the southern and western lines continue to the Saliqueló Station, and from there turn to Bahia Blanca, with a branch in front of Saliqueló to finish at Villa Mercedes (San Luis). The electric traction will be used over an extension of 50 kilometres, where the traffic is more frequent.

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics.*

8803. F. Cotton, Liverpool. April 26th.—An improved apparatus for burning liquid fuel in conjunction with steam.

8815. G. W. Johnson, London. April 26th.—Improvements in devices for feeding powdered fuel to furnaces and the like. (*C. A. Matcham, U.S.A.*)

8817. J. McNaugher, London. April 26th.—Improvements in pulleys.

8831. A. Stodola, London. April 26th.—Improvements in or relating to gas turbines. (Date applied for April 30th, 1904.)

8833. A. S. F. Robinson, London. April 26th.—Improvements in steam boilers.

8839. H. F. Weinland, London. April 26th.—Improvements in boiler-tube cleaners.

T. Bamforth and R. P. Roy, London. April 27th.—Apparatus for governing the speed of pumping engines and like motors.

8870. F. M. Mole, London. April 27th.—Improvements relating to steam turbines and like prime movers.

8881. P. Stinner, London. April 27th.—Explosion turbine.

8903. C. H. T. Alston, London. April 27th.—An improved clutch device for connecting shafts.

8923. P. Davies, London. April 27th.—Improvements in and relating to steam generators.

8924. H. M. Smith, London. April 27th.—Improvements in bearings for rotary shafts. (Date applied for May 2nd, 1904.)

8936. L. Hand, Birmingham. April 28th.—An improvement in water valves.

16095. W. J. Foster, Birmingham. August 8th.—Improvements in tuyeres and coolers of blast furnaces and the like.

16110. G. and F. L. Watson, Leeds. August 8th.—Improvements in mechanical stokers.

16120. W. B. Thomsen, Paris. August 8th.—Improved device for steering the outlet valve, and for regulating the lubrication of four stoke engines.

16122. H. Holt, London. August 8th.—An improved method of utilising exhaust steam from steam engines and the like for preventing or lessening condensation within steam engine cylinders and for driving turbines.

16135. Humber, Ltd., T. C. Pullinger, London. August 8th.—Improvements in or relating to variable speed and reversing mechanism.

16157. T. J. Blackmore, London. August 8th.—Improvements in rudders.

16160. L. Y. Spear, London. August 8th.—Buoyancy regulating apparatus for submarine boats. (Date applied for, August 10th, 1904.)

16161. A. Berry, London. August 8th.—Improvements in journal lubricators.

16164. H. H. Spears, London. August 8th.—Improvements in machine for press-concrete bricks. (Date applied for, June 10th, 1904.)

16179. F. R. Simms, London. August 8th.—Improvements in or connected with electrical ignition gear for interal combustion engines.

16188. R. Nuttall, Manchester. August 9th.—Improvements in shaft couplings and in combined governing or controlling and indicating apparatus.

16200. H. A. Mollison, Glasgow. August 9th.—Improvements in direct acting pumps.

16215. S. H. Adams, Scotswood-on-Tyne. August 9th.—Improvements in revolving distributors.

16220. F. Noe, London. August 9th.—Improvements in portable sand blast apparatus.

16226. A. M. Robeson, London. August 9th.—Improvements in and relating to furnaces.

16244. E. Hanke, London. August 9th.—Improvements in locomotive engines.

16254. A. G. Grice and G. Anderson and Co., Ltd., Dundee. August 10th.—Improvements in stone sawing machinery.

16260. J. W. Brown, Leeds. August 10th.—Improvements in variable speed gearing.

16281. H. J. Green, London. August 10th.—Improvements in steam separators.

16283. H. Symonds, J. Cochar, and H. Harker, London. August 10th.—Improvements in guards for laundry machinery and the like.

16288. J. B. Semple, London. August 10th.—Improvements in and relating to tracing projectiles.

16309. W. H. Glaser, London. August 10th.—Improvements in or relating to turbines.

16326. A. B. Chatwood, Manchester. August 11th.—Improvements in valve operating and controlling mechanisms.

16349. S. W. Dalzell, Glasgow. August 11th.—Improvements in the manufacture of rails.

16351. H. Collet, London. August 11th.—An improved method of supporting shafting.

16366. J. R. Branch, London. August 11th.—Improvements in boring machines.

16408. T. B. Fyfe, London. August 12th.—Improvements in ships' propellers.

16427. C. V. Kerr, London. August 12th.—Improvements in and relating to compound steam turbines.

16439. W. Geipel, London. August 12th.—Improvements in steam traps.

RECENT SPECIFICATIONS.

IMPROVEMENTS IN MECHANISM FOR OPERATING THE VALVES OF STEAM ENGINES AND THE LIKE.

F. Lamplough and the Albany Manufacturing Company, Ltd., Willesden. June 22nd, 1905.—This invention relates to improvements upon that class of mechanism for operating the valves of steam engines and the like in which a gear wheel on the engine crank shaft communicates motion to the shaft carrying the valve operating cranks, eccentrics, or cams by means of movable intermediate gearing, and a gear wheel fixed on the said valve operating shaft whereby the relative position of the valve operating cranks, eccentrics, or cams with relation to the engine crank shaft can be readily varied. The accompanying drawings, in which fig. 1 is a longitudinal section, and fig. 2 an end elevation of one form of the improved apparatus, illustrates the engine crank shaft on which is keyed a skew-toothed or screw-threaded wheel, which latter gives motion to a pair of right and left-handed skew or screw-threaded wheels, by gearing with the wheel shown. The wheels, as shown in the drawings, are formed of one solid piece, fitted at ends with ball thrust bearings, and are mounted on a non-rotating shaft or rod which they are bored to fit. The said wheels may, however, be formed separately, and fixed on a sleeve fitting the shaft or rod, or they may be fixed or formed on a rotating sliding shaft. The left-hand skew or screw-threaded wheel gives motion to the shaft carrying the valve cranks, eccentrics, or cams, by gearing with a skew-toothed or screw-threaded wheel fixed on such shaft. It will be evident that it is immaterial which of the wheels is right or left-handed, so long as they are the reverse of each other, and the gearing wheels are respectively formed to gear therewith. The whole gearing is enclosed in an oil bath or casing, and the shaft or rod works through bearings formed at the ends of said casing. One end of the shaft or rod as shown in the drawing has an eye by which, and by suitable connections, it is connected to the hand lever of the engine, or the endwise position of such shaft may be controlled by a governor. In the case of the screw-threaded wheels being fixed or formed on a sliding rotating shaft, such shaft would be moved endwise by a fork lever. Thus, by moving the shaft or rod endwise in its bearing, the gearing will cause the valve cranks, eccentrics, or cams to assume different relations with respect to the engine cranks, and thus cause the engine to have an earlier or later cut off and reverse.

Fig. 1

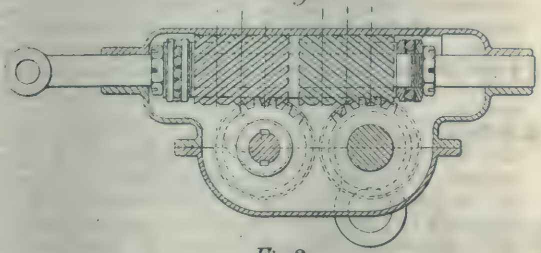
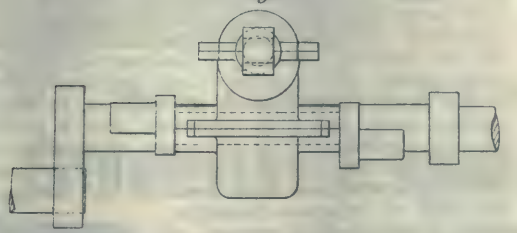


Fig. 2



IMPROVEMENTS IN CONNECTION WITH PUG-MILL.

John William Craven, Wakefield. August 25th, 1904.—This invention relates to pug-mills, such, for example, as are used in combination with brick-making and like machines, and the object of the invention is to provide such pug-mills, with means whereby the upward thrust of the pug-mill shaft is borne in such a manner as to keep the knives, stirrers, or propellers of the pug-mill well down to their work without interfering with the proper rotation of the pug-mill shaft, and also to prevent rapid wear by the gyratory action of the pug-mill shaft consequent on the rotation of the knives, stirrers, or propellers. The drawings represent an arrangement in accordance with this invention, and shows the pug-mill and its shaft, carried in bearings, and provided with the knives, stirrers, or propellers, as usual. The upper end of the said shaft has a hard metal surface at top, formed with an annular race in which are received hard metal balls. Above the said shaft is a cross-piece, carried by standards, and having, at the part opposed to the race, an inverted hard metal race in which the balls also run. In the upper side of the cross-piece is a recess in which is a bush forming a bearing seat for the driver, or main shaft, which is carried in other bearings in the framing in the ordinary, or any suitable, way, and drives as usual the pug-mill shaft and the other parts of the machine with which the pug-mill is used. The lower bearing is shown, provided the rollers, which take the bearing of the shaft, so as to obviate excessive wear caused by the gyratory action of the shaft, consequent upon the rotation of the knives, stirrers, or propellers. The bearing may also be provided with a similar arrangement, but generally this will not be necessary, as the rollers (or balls) in the lower bearing will sufficiently answer the purpose. Fig. 1 shows in elevation so much as is necessary to illustrate the application of the said invention. Figs. 2 and 3 are elevations at right angles to each other, and fig. 4 is a plan of the ball bearing for the upper end of the pug-mill shaft.

Fig. 1.

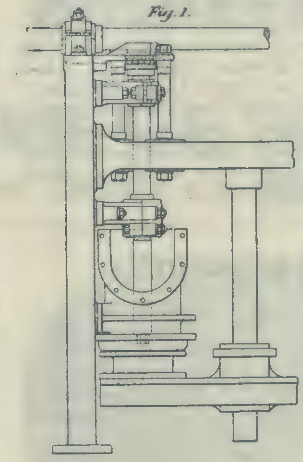


Fig. 2.

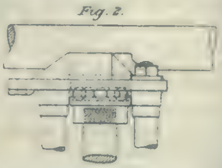


Fig. 4.

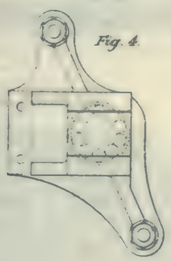
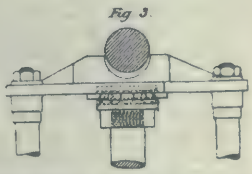


Fig. 3.



NEW PUBLICATIONS.

"HYDRAULIC MACHINERY."

With an introduction to hydraulics. By Robert Gordon Blaine, M.E., A.M.Inst.C.E. Second Edition. E. and F. N. Spon. 14s. net.

The fact that Mr. Blaine is senior lecturer in the mechanical engineering section of the City and Guilds of London Technical Institute is an assurance that he is admirably suited for the authorship of a work of this character, which aims at furnishing the student with a reliable handbook on hydraulic machinery. The general scope of the volume is so well known that it is here only necessary to call attention to the more salient features of the new edition, which bears throughout ample evidence of careful revision. Amongst the new material will be found a section devoted to the stability and resistance of ships, the efficiency of centrifugal pumps, and graphic methods. As would be expected, the question of turbine design receives considerable attention, and data is included bearing on turbines for low falls, the largest turbine constructed, hydraulic governors, and a description of the powerful governors in course of erection to control the Ontario Power Company's 10,000 h.p. units at Niagara. This matter is fully illustrated and the same advantage applies to the sections on hydraulic gas-stoking machinery, hydraulic foundry and steelworks cranes, and a hydraulic gantry. The author has entirely rewritten the "Hydraulics" section, new tables have been inserted, and recent experiments and deductions introduced. The chapter on hydraulic rams has been extended to more than twice its original length and most of the typical forms are described and illustrated. Extensive use, says Mr. Blaine, has been made throughout of curves or graphs, as it is often of more importance that a student shall be able to form a good idea of the law of variation of two related quantities, than merely to obtain their numerical values under given conditions. A commendable feature of the book is the series of excellent folding drawings, the practical value of which will be fully appreciated by the earnest student.

BOOKS RECEIVED.

"A Guide to Standard Screw Threads and Twist Drills." By George Gentry. (Percival Marshall and Co. 6d. net). The latest addition to the well-known "Model Engineer Series" deals with the following standard screw threads: The Whitworth, the British Association, bicycle screws, the V Standard, the U.S.A. Standard, the International Metric Standard, watch and clock screws, and twist drills. The various tables showing diameter, tapping and clearing sizes, etc., are printed on one side of the paper only so that they may be extracted and mounted for regular use in the workshop.—"Analysis of Silicon (Graphitic) and Siloxicon." By Percy E. Spielmann. (Vacher and Sons.) An interesting paper reprinted from the Journal of the Society of Chemical Industry. — "Transactions of the Institute of Marine Engineers." Volume XVII. (Spottiswoode and Co.) The present issue contains among others, papers on British standard flanges, the development of the torpedo boat destroyer, and the work of the Engineering Standards Committee.

"Electrical Practice in Collieries." A manual for colliery managers, under managers, engineers, and mining students. By Daniel Burns, M.I.Mech.E. Charles Griffin and Co., Ltd. 7s. 6d. net.

"Principles of Electrical Power (Continuous Current) for Mechanical Engineers." By A. H. Bate, A.M.I.E.E. E. and F. N. Spon 4s. 6d. net.

"Transactions of the Junior Institution of Engineers, 1903-4."

NEW CATALOGUES.

Lightning arresters for alternating and continuous current circuits is the subject of a pamphlet recently issued by the British Thompson-Houston Company, Ltd., the various types of arresters are illustrated from photographs.

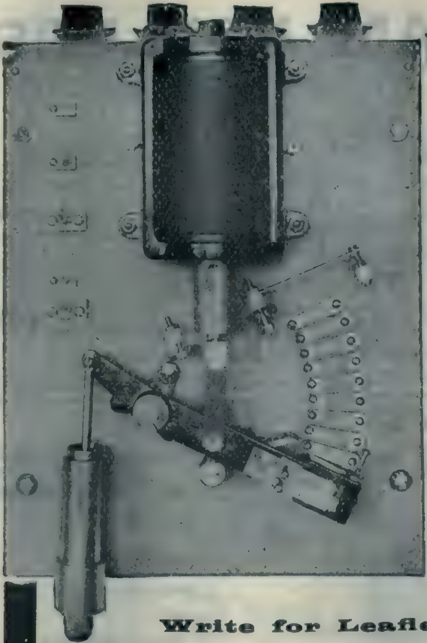
The Paterson Engineering Company, Ltd., of Amberley House, Norfolk Street, W.C., have sent in their leaflets B and D. The first illustrates and describes the firm's water softener and filter, while the second deals with the Paterson Grease Eliminator for removing the last trace of oil from greasy condensation water.

We have received from the British Steam Specialities Ltd., sectional catalogue No. 16, which is devoted to pipe fitting specialities in connection with steam and water supplies. In order to facilitate reference the contents of the catalogue are conveniently indexed. Among other productions of the firm the following are listed: gun metal valves; improved asbestos packed water gauges; silent water heaters; recording thermometers; automatic air valves; anemometers and air-meters.

B. J. Hall and Co., 39, Victoria Street, S.W.—From this firm we have received a new catalogue which appears to include every conceivable desideratum for the drawing office. In their introduction Messrs. Hall and Co. state that they have endeavoured to meet completely the requirements of both experts and beginners. It is mentioned that factories have been established in London for the production of cylindrical electrical copier apparatus, flat frames for sun printing, drawing tables and cabinets, and photo-papers for engineers and architects. Five of the firm's establishments are engaged in reproduction work, and it is mentioned that a process has been perfected by which copies of drawings or tracings can be obtained in jet black lines on strong white paper, the lines being insoluble and the paper free from all injurious chemicals.

Sturtevant Engineering Company, Ltd.—The fifth revised and enlarged edition of the firm's treatise on "Ventilation and Heating; Principles and Application," has been issued, and takes rank as a catalogue *de luxe*, being a tastefully bound and useful acquisition for the bookshelf. We are reminded incidentally that the firm have warmed and ventilated many of the best known engineering works throughout the world; among others those of Messrs. Clayton and Shuttleworth, Ltd., Lincoln; Messrs. Marshall Sons and Co., Gainsborough; and Messrs. Siemens Bros. and Co., Ltd., Stafford. We have here not merely an advertising pamphlet, but a scientific treatise on a subject of vast importance, in which the facts are lucidly set forth. According to the writer, the ideal installation of the Sturtevant system is in the three or four-storey brick factory of the type of the ordinary cotton mill, where the heated air is conducted from the apparatus through a duct in the basement to the bases of special pillaster flues located upon the outside at regular intervals along one side of the building. The horizontal duct constructed of brick usually extends along the interior of the basement wall, and is provided with either a flat or arched top of approved and air-tight material, or is made quadrant in form, thereby securing for a given expenditure of material the maximum area for the passage of air. At distances varying from 40 to 75 ft. the piers between the windows are carried out and form the pilaster flues which receive the heated air from the duct, and discharge it above the head-line on each floor.

PAGE'S WEEKLY Miscellaneous



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147, QUEEN VICTORIA STREET, LONDON, E.C.

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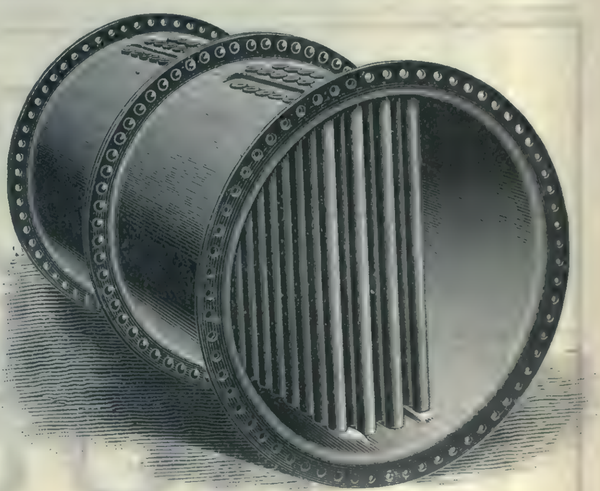
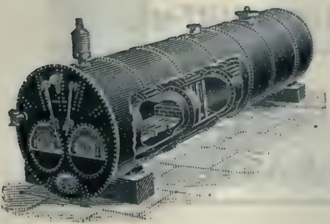
Economy in your Fuel account guaranteed by using Premier Boiler Tubes. These Tubes can be fitted to any Lancashire Boiler, and will **INCREASE** the evaporative efficiency

20 *per Cent.*



Part view of Flue fitted with PREMIER TUBES.



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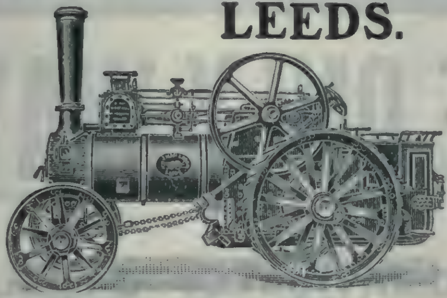

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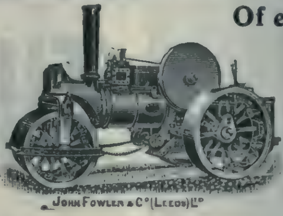
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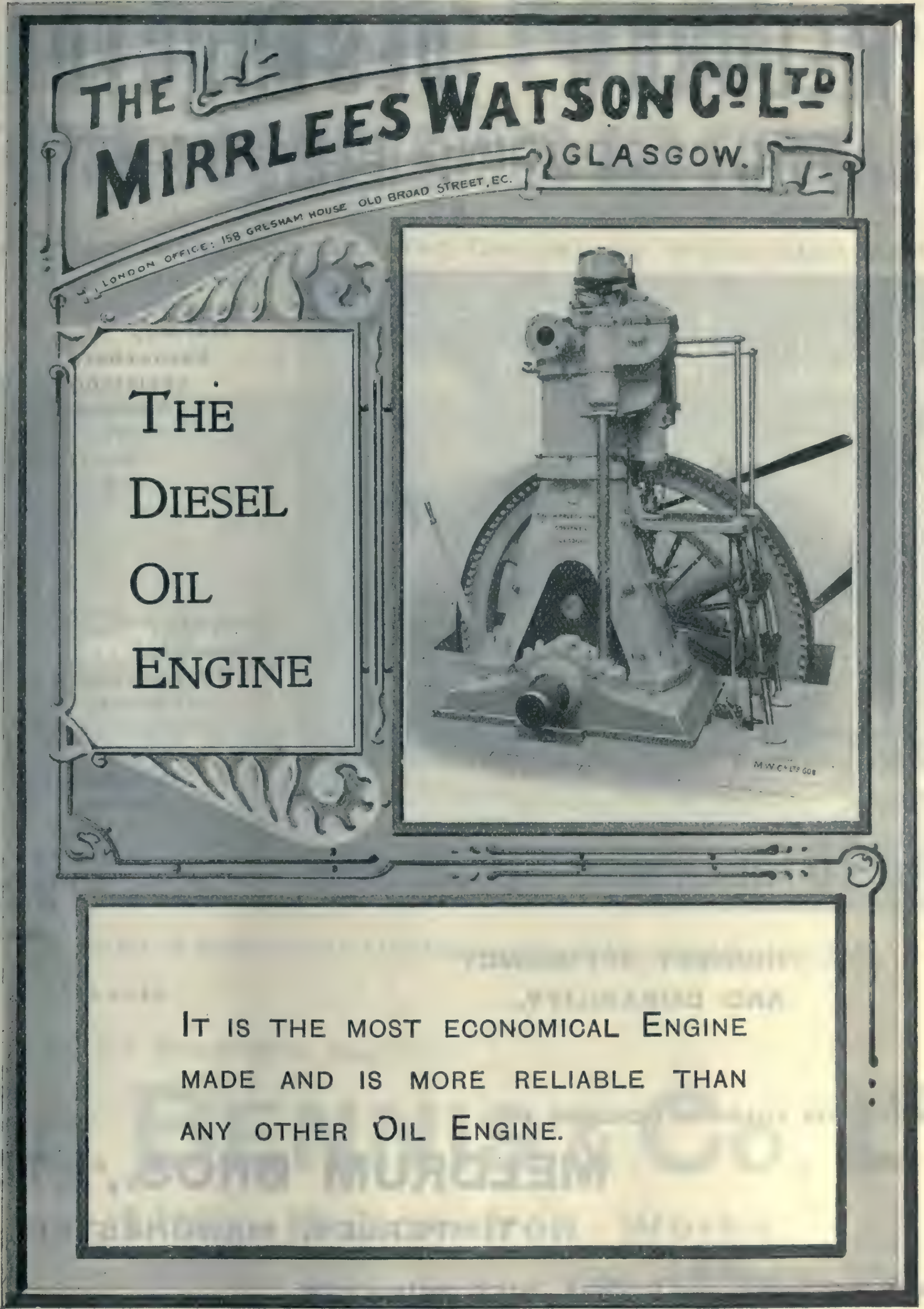

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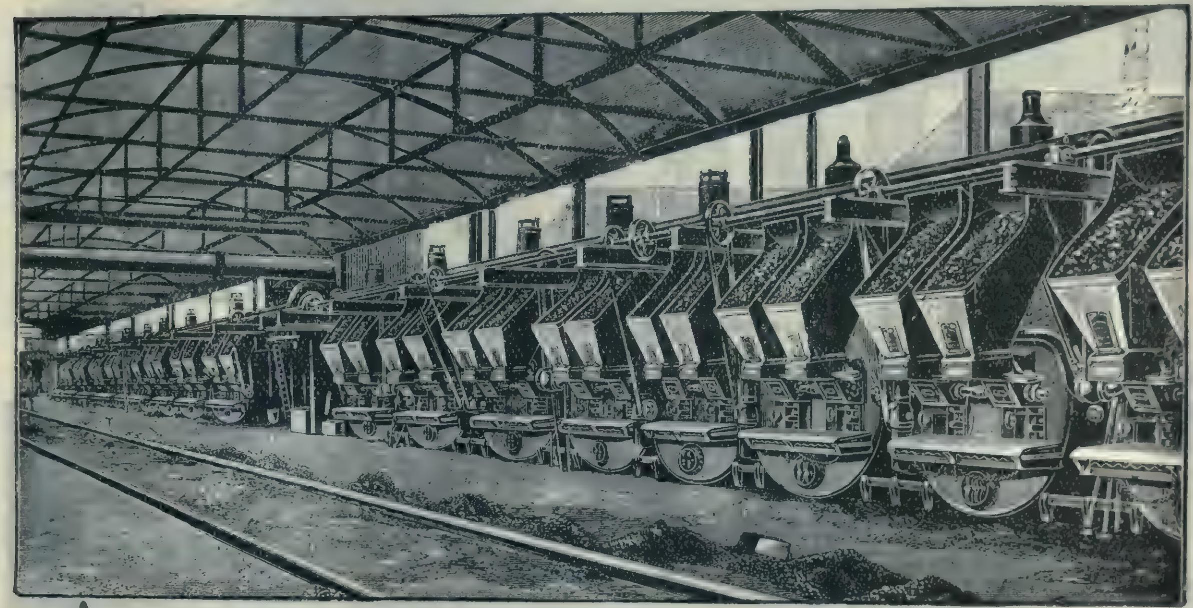

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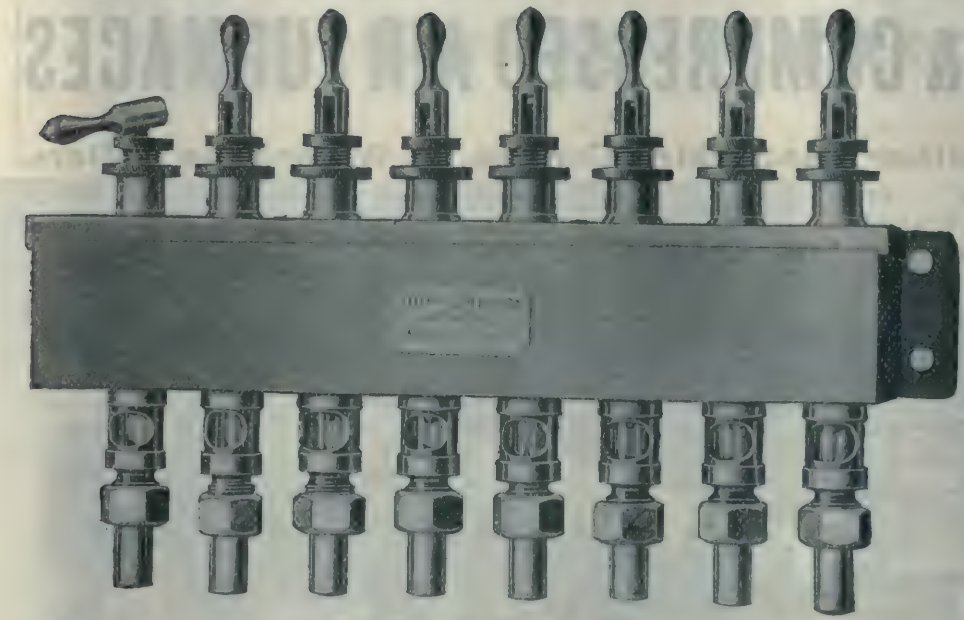

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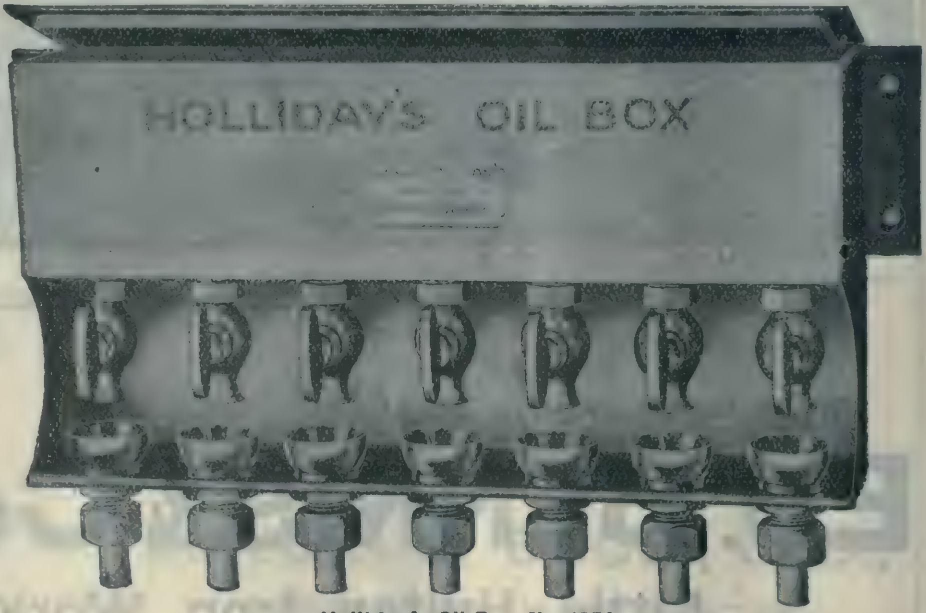

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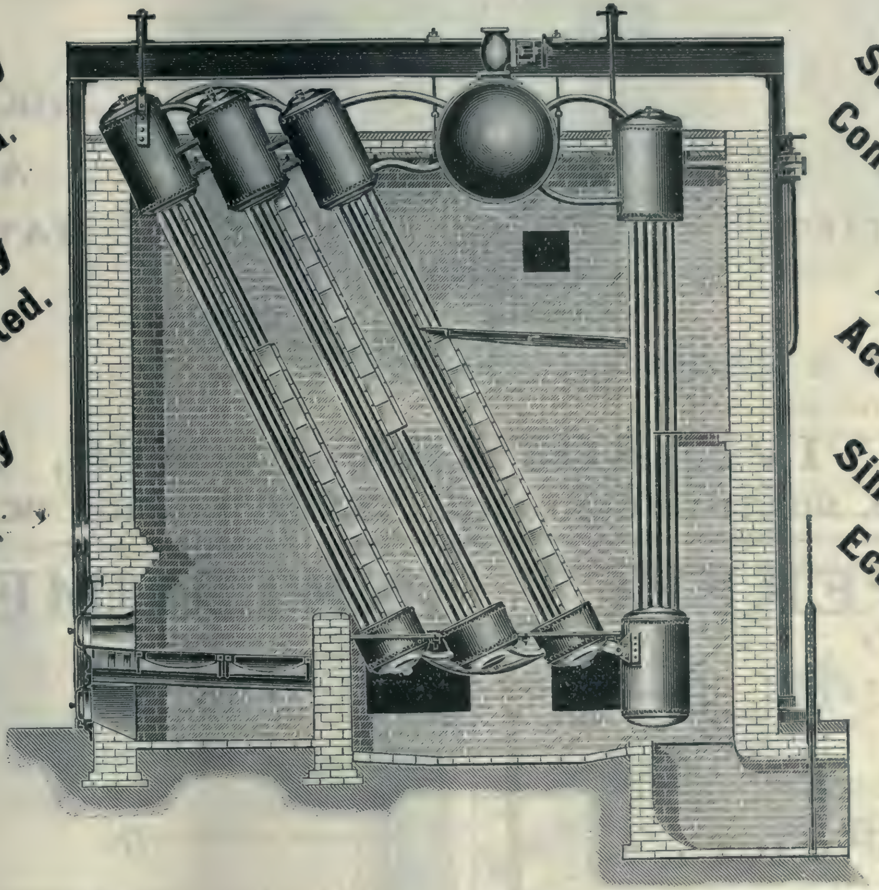

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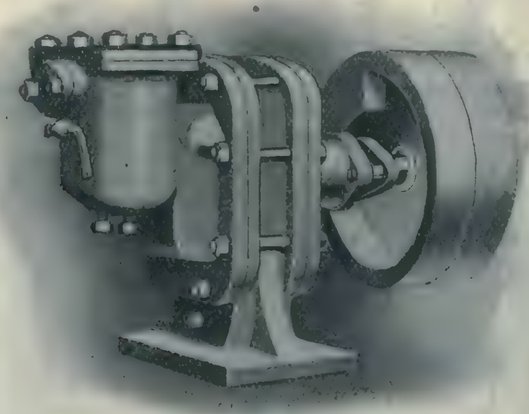

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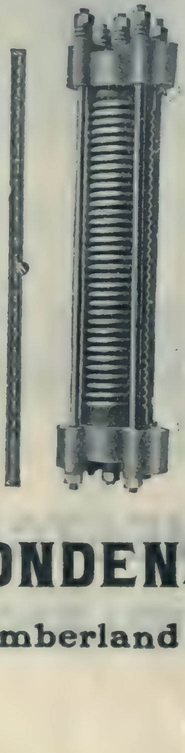

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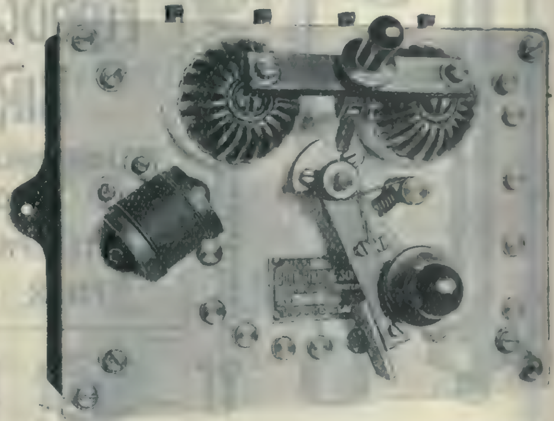

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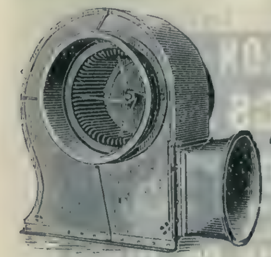

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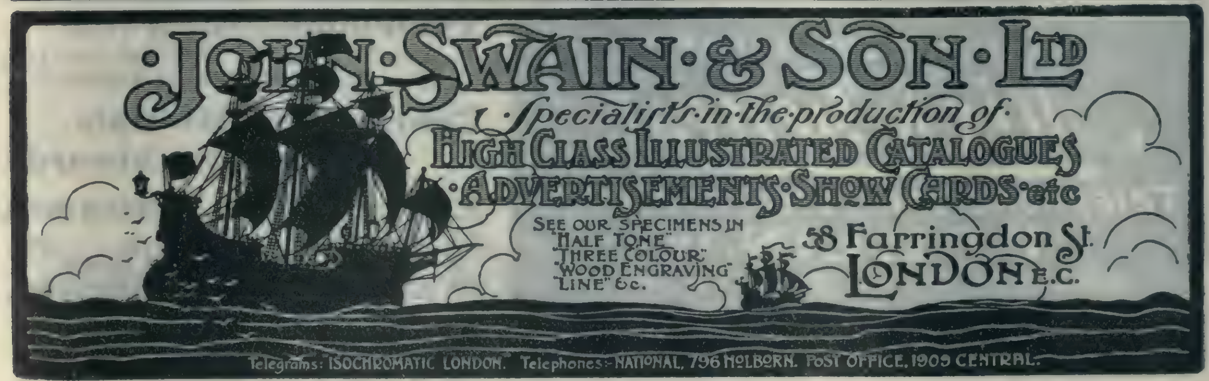

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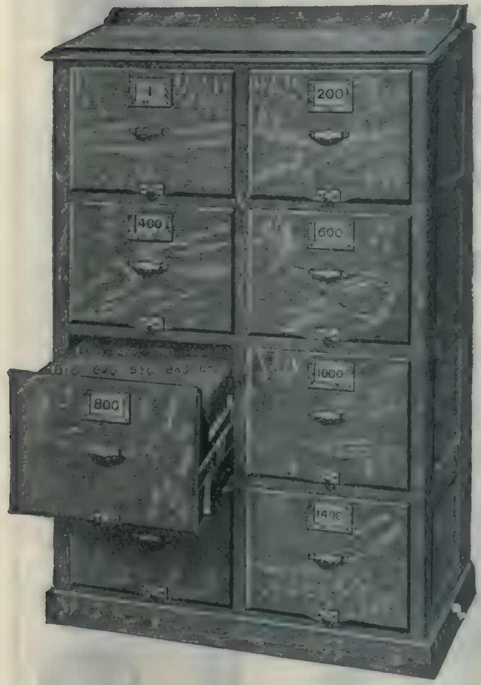

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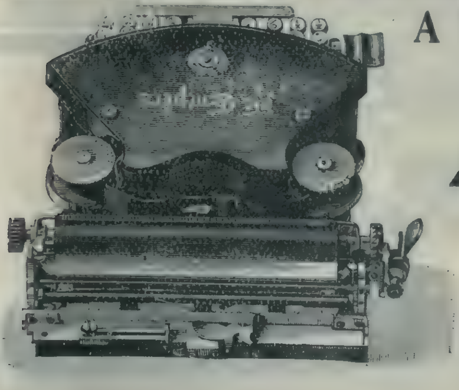

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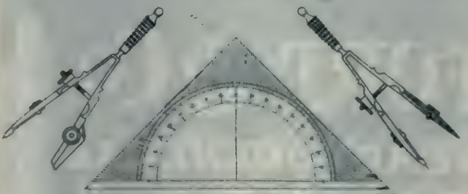

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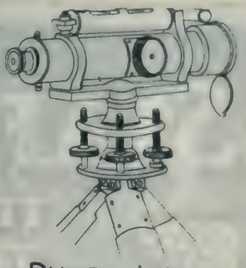

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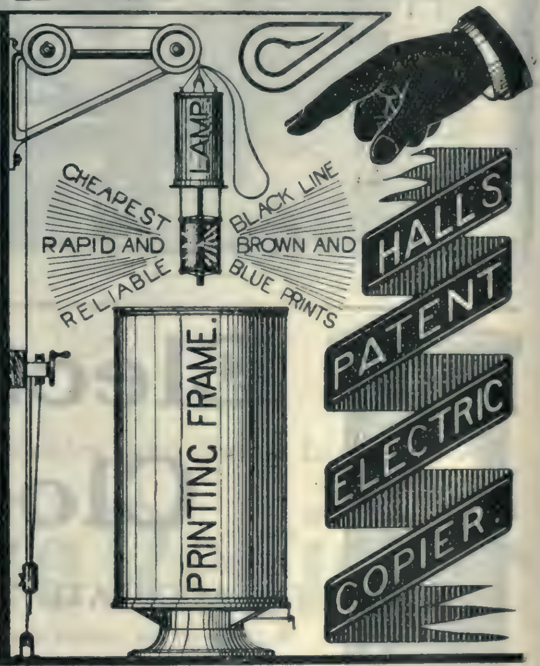

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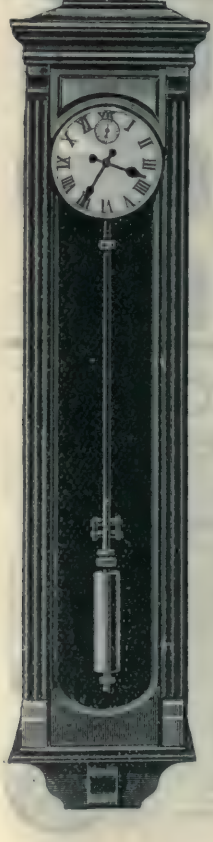

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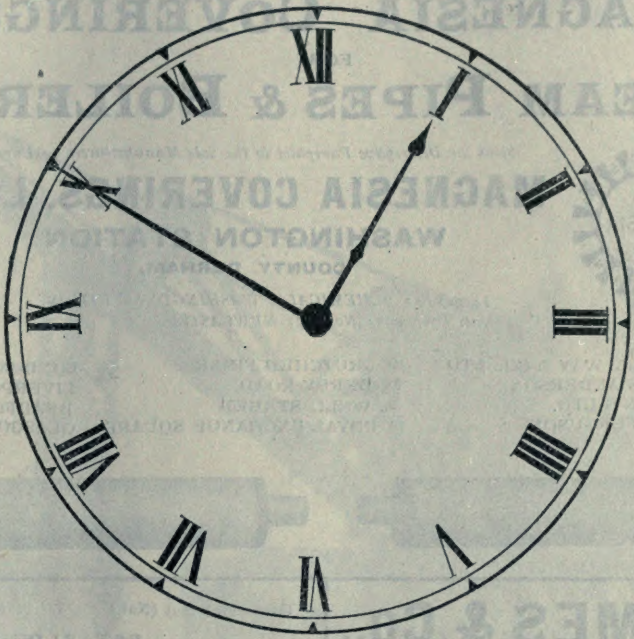

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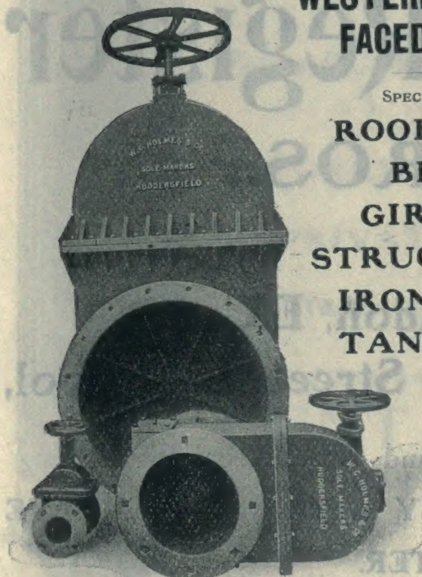

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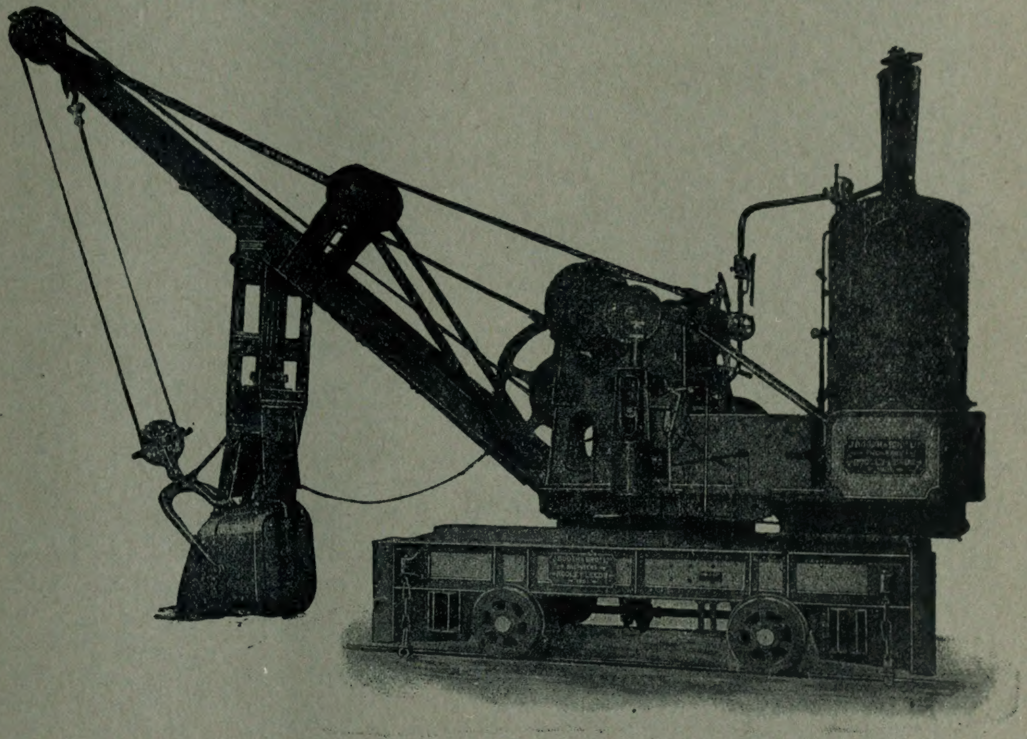

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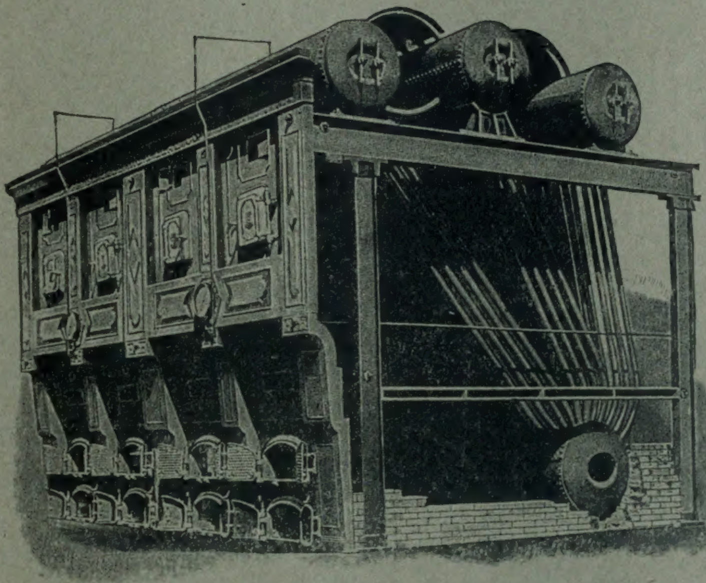

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